Hold for Vol 2.

TELEPHONE ENGINEER

Vol. I CHICAGO, JANUARY, 1909 No. 1

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¶ Electricity Magazine Corporation, as a name, has the jingle of something more pretentious than it is. We use it, first, because it is something that belongs to us, and second, because it is a convenient thing to use. There is nothing the matter with the corporation—"it owes nobody nothing." It isn't seeking credit. Its stock book is worth more than its bank book, because the stock book cost real money and the bank book was furnished free by the bank. Any one who cares to see the stock book is welcome, but our modesty precludes the same privilege with the bank book!

¶ But we elect to use the name of the high-sounding organization for the first named reason—it's our prerogative.

¶Telephone Engineer is presented without any blare of trumpets. It is the culmination ot an idea that has been entertained by one of its editors for the past seven years. During this period he has been identified with all the telephone publications worth while. (Apology is due to those publishers who might take exception to our use of "worth while.")

¶ This idea contemplates a class paper as being a common carrier. That advertising properly intended for a class paper should be accepted by the publisher of that class paper. The right to sell is reserved on the same presumption that a manufacturer or dealer claims such right.

¶ This publication will ignore the mooted "dead-line" that has been the bane of one of the greatest industries of modern times. The manufacturers of telephone equipment are upon a competitive basis. They will survive or fail as they recognize or ignore that point. They buy raw materials upon a competitive basis; they manufacture product on a competitive basis; they sell on a competitive basis. Their salesmen clash in the field. There is no probability of combination—no hard and fast rule that is likely to change the condition.

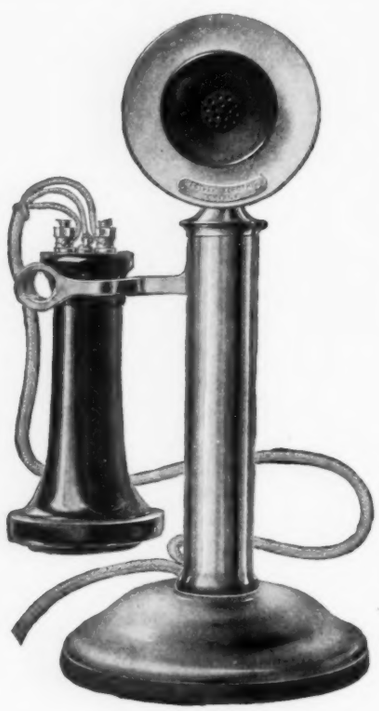
¶ The future of the business requires something more than selfish bias. If our contention is wrong, it will be our loss—not yours—and we may be foolish enough after awhile to start a railroad magazine and in its conduct boost the whole railroad game, always to the exclusion of the Harriman system.

¶ Telephone Engineer will be very much better as it grows older, although we are rather proud of this first issue. Considering its extreme youth and the hardship of its making with the foundation of a bare room a month ago, we call it good.

¶ And in passing should you want to say something on this page next month, you may; but it will cost $75.00 in new depressed gold coin that you can see by going to the bank. Our proposition is a business one. We will try to convince you of that as we go along.

Start the New Year Right by Installing Western Electric Telephones

THE transmitter and receiver shown below are known to every telephone user from the Atlantic to the Pacific and from the Lakes to the Gulf; they are Western Electric telephone instruments and by means of them the most important business of the country is transacted.



Some Reasons Why

Our Valuable and Extensive Experience in the telephone manufacturing field, covering a continuous period of thirty-one years.

The Advantages Accruing from the Enormous Output of factories, which is greater than the combined output of all other manufacturers of telephone apparatus.

Our Carefully Trained Staff of Engineers, designers and mechanics are constantly producing new telephone apparatus and supplies, improving the old and developing to the highest stage of perfection the goods marketed.

A Large and Complete Stock of standard transmitters and receivers and of other telephone instruments and supplies is carried in saleshouses located in eighteen of the principal cities of the United States, which affords our customers an opportunity to enjoy the benefits derived from prompt filling of orders of any size, together with a saving in transportation expenses.

WESTERN ELECTRIC COMPANY

EASTERN
New York
Philadelphia
Boston
Pittsburg
Atlanta

CENTRAL
Chicago
Indianapolis
Cincinnati
Minneapolis

Manufacturers and Suppliers of all Apparatus and Equipment used in the Construction, Operation and Maintenance of Telephone and Telegraph Plants

WESTERN
Saint Louis
Kansas City
Denver
Dallas
Omaha

PACIFIC
San Francisco
Los Angeles
Seattle
Salt Lake City

Northern Electric and Manufacturing Co., Ltd., Montreal and Winnipeg

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TELEPHONE ENGINEER

VOL. I CHICAGO, JANUARY, 1909 NO. 1

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ELECTRICITY MAGAZINE CORPORATION

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach the office of publication not less than ten days in advance of date of issue. Regular date of issue, the first day of each month. New advertisements will be accepted up to within five days of date of issue, but proof of such advertisements can not be shown until the appearance of the edition containing it.

NOTICE TO SUBSCRIBERS.

REMITTANCES.—Remittances should be made by check, New York draft or money order, in favor of TELEPHONE ENGINEER. Foreign subscriptions may be remitted direct by International Postal Money Order, or sent to our London office.

CHANGE OF ADDRESS.—The old address should be given as well as the new, and notice should be received two weeks in advance of the desired change.

DATE ON WRAPPER indicates the month at the end of which subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publisher.

CLUB RATE.—In acknowledgment of assistance rendered by subscribers in the securing of new orders, a club rate of $1.50 per annum is quoted. This rate applies to subscriptions in clubs of two or more, which contemplate new subscribers.

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CHICAGO, JANUARY, 1909.

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THE SIMPLE REASON.

BEGINNING right here and continuing down the column of this particular page, you expected to find an editorial expression bearing directly upon the subject of this new magazine. It is a custom with which you have grown familiar, for into your hands has fallen a copy of a first edition. You are curious to see the publisher's statement—to read his apology, or its equivalent, first—and pass an estimate upon his effort afterwards.

So right at the start we will stick to tradition.

This is where we make our bow, although we've been rehearsing it since December 8 last, when a limited number of circulars were issued to unsuspecting telephone people who were not above suspicion! These circulars might have gone out a little sooner, but the lithographer and printer had something to do with them. We have called them circulars, but they turned out to be circulators, for almost instantly after their appearance, rumors were circulating, hinting a deep, dark-laid plot. But in the telephone business that was to have been expected.

Here is the plain announcement, bearing date of December 8, 1908, just as we sent it forth:

Electricity Magazine Corporation announces TELEPHONE ENGINEER to appear in January. The publication will issue monthly.

It will represent the telephone industry in a manner never heretofore attempted. The mission of the publisher will be to treat fairly and impartially the whole wide domain of the telephone business, serving the art along the lines of the best engineering, construction and operating practice.

The commercial side of the telephone business, considered broadly as including the interrelations of manufacturers, plant owners and telephone users, has now developed into a condition very similar to other commercial industries, and it promises to continue securely on this basis indefinitely into the future.

TELEPHONE ENGINEER will advocate competition in both the manufacturing and operating departments of the telephone business, believing that such a plan will enhance every interest involved.

We believe you will be quick to see the beneficial advantages of an independent and truly representative publication.

That's all there was of it. The process of addition and subtraction was completed long ago. However, we care to emphasize first, that

TELEPHONE ENGINEER will advocate competition in both the manufacturing and operating departments of the telephone business; and second,

The aim of the publisher will be to treat fairly the whole wide domain of the telephone business, serving the art along the lines of the best engineering, construction and operating practice.

In these respects the magazine will differ from any other telephone publication that has ever gone before.

We have been deliberate in adopting a course which has proven sound in all trade publications representing other industries. We know the condition of the telephone business as it has existed and we have well defined ideas concerning the chief causes which affect it at present.

Telephone Engineer will be subservient to no single interest to the detriment of any other. It will be an independent publication with a little "i" and we hazard the opinion that you have a well defined notion as to that meaning. If you haven't, watch us. If you're anxious, ask us, but don't forget to send along the price of a year's subscription.

COMPETITION IN THE BUSINESS.

THE American Telephone and Telegraph Company is opposed to competition in the telephone business. It holds stock predominance in practically every sub-licensee Bell company. When it can buy the controlling interest in a well managed, substantial independent operating company, it does it. All of this shows monopolistic tendency.

The independent telephone companies of the United States are opposed to competition in the telephone business. They would be glad to control the stock of the American Telephone and Telegraph Company. When an independent company can secure all of the business in any community, it is satisfied. This also shows a monopolistic tendency. It is also an exemplification of human nature.

Telephone Engineer believes in competition in the telephone business. It believes in a choice. When we talk to Milwaukee we want a preference. When we go up there for our pretzels, we can choose between a lot of railroads, steamships, trolleys and things. When we talk, there is only one way. The element of service and civic regulations does not satisfy. We want a choice. That's the best reason we know for competition and it also carries another large element of human nature with it.

But there are other reasons which may be considered more vital. Time has taught us that telephones have been multiplied under telephone competition; rates have been reduced; service has been improved; invention has been encouraged; villages have been supplied with service; farms have been connected; toll lines have been extended; isolated places have been brought out into the open.

Competition has never been known to divide a satisfactory service already existant; it has never been known to increase the cost of service in equal ratio with utility, and its has wasted very little that the future will not require.

The life of any business depends upon competition regardless of whether it is waged between a powerful corporation on the one hand and a multiplicity of smaller concerns on the other hand.

This is a country of free speech. The telephone is a device to transmit speech. Its ramifications should extend to the remotest corners of the earth to enable men to converse freely. The function of the telephone is limitless; its development mediocre.

A country cannot be wholly free if speech is to be restricted by a monopolized contrivance of mankind.

There is nothing new in the anomaly of the telephone operating business, which proves that the greater the required service, the higher is the cost of production. It is contrary to nearly every other kind of business, but the truth is emphasized in all communities where the service is monopolized by either the Bell or independent operator.

There is too much misinformation concerning the subject of dual service. The telephone user never needs all the subscribers to a single system after it has developed beyond the first few instruments, but the extension of that system makes it more and more valuable to every subscriber. The alleged burden of a second system affects less than 15 per cent of the list and statistics show that a large portion of this class would require two telephones if confined to the restrictions of a single system.

No better example can be cited than is offered at Columbus, Ohio, where the first operating company was serving 1,900 telephones prior to the advent of the second system. The business rate was $96.00 per year. The second system adopted a $40.00 rate for business service. The first company reduced its rate to $54.00, which effected a saving of $2 a year to the subscriber who required both services.

Competition has increased the number of subscribers to the first system from 1,900 to approximately 11,000. In the meantime the second system has developed an equal number of patrons. Columbus has 22,000 telephones as a result of dual service. The manufacturer has had his profit on 20,000 instruments as a direct result of competition. It can be taken for granted that the service is better today than it was before the advent of the second system.

Nothing is quite so misleading as the cry that the telephone is a natural monopoly.

THE YEAR THAT IS GONE.

THE contention that the telephone industry is so stable as to be little affected by financial tides is well borne out in the records of the past year. True, the manufacturers of telephonic apparatus may have experienced much of the general business stagnation, for the operator as a rule has been content to hold his own, and has made comparatively little attempt to undertake new construction work. That the operators have succeeded in doing the former practically without any loss of established business is evident, and almost without exception the manufacturers have weathered the storm with but slight inconvenience. Now that the deferred projects for development and improvement are becoming live issues, and the numerous organizations formed during the period of inactivity are preparing to give concrete expression to their plans, the wise manufacturer is arranging to meet the early release of a tremendous purchasing power, backed by the demands of restored business confidence.

In the meantime necessity has in many cases forced schemes of reorganization and systematization and the planning of new and aggressive campaigns for business which cannot but be beneficial to the immediate development of the industry. In some localities where competitive conditions were strenuous the weaker company has succumbed to the lure of combination; but in most cases the monopoly will be short-lived. The majority of communities have become educated to the advantages of the dual system, and there are plenty of enterprising men ready to take advantage of the opportunity which always exists in a territory served by a single system. Especially is this true of places which have lost those advantages through combination.

The business depression is also largely accountable for the adoption of the clearing house plan in toll work,

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whereby toll rates and mutual long-distance business are economically adjusted on a more equitable basis.

The problem of rates has also received due consideration, and there is visible a tendency to co-operation between opposing systems in the cessation of cut-rate warfare and the establishment of at least a living rate.

The long-distance system of the country has been extended to Denver, Colorado. The underground cable toll line between Chicago and Milwaukee is a further development of long-distance work, and the "loading" of these lines to maintain the transmission standard has also been made more exact.

The automatic systems have kept full pace with the manual, and there is manifest a tendency of the makers of manual apparatus to standardize certain forms of automatic signaling and ringing devices. The semi-automatic systems, while too new to have come into extended use, display healthy indications of future importance.

The progress of telephonic train dispatching has been remarkable. It has not only graduated from its purely experimental position of a year ago, but is rapidly becoming universal. Its use in interurban railway work, while already common at the beginning of the year, has made encouraging strides.

The advance of wireless telephony has been steady and interesting. Its application has kept pace with the acquisition of technical knowledge and transmission distances of several hundred miles have been attained.

The year has also seen a gratifying improvement in the attitude of the public toward the telephone machine. Appreciation of the difficulties of the girl at the switchboard has come with the popular understanding of quasi-technical telephony, which knowledge has been disseminated to some extent by the press and the popular magazines. A few operating companies have devoted a considerable portion of their advertising appropriations to this species of education.

During the year 1908 there were issued, approximately, 400 patents pertaining to the telephone art. During the dull period manufacturers have given considerable attention to invention and the development of apparatus which promises an interesting series of patents for the next few years.

The coming year promises much. The unsatisfactory conditions which 1908 has given time to analyze will be corrected. The Bell interests will undoubtedly profit by a study of the causes for the popularity of the independent movement, while the independents will benefit through appreciation of Bell systemization. Possibly the spirit of competition may be expected to develop a less hostile aggression, a more business-like action. At any rate, the telephone user will unquestionably profit by the period of meditation which the producers of service have enjoyed.

CHICAGO TELEPHONE FRANCHISE.

POSSIBILITIES for a second telephone system in Chicago are not promising. The Illinois Tunnel Company, holder of a second franchise for a modern telephone system, has concluded that a general freight business is quite sufficient for it to undertake and carry forward successfully. Whatever may have been the original underlying motive, the telephone franchise granted to the Tunnel company has made the freight business possible.

In December the Tunnel company was a supplicant for additional amendments to its franchise before the city council. It begged a time extension to develop a telephone system or sell its rights to do so. The Chicago council granted its prayer. The company can build or sell. The probabilities are that it will do the latter. Further probability suggests that it will sell to the Chicago Telephone Company, itself holder of a similar franchise.

Through the council committee on gas, oil and electric light Chicago has gone into the telephone situation with commendable foresight. The council committee appointed a special committee of telephone engineers to investigate the whole matter, and this special committee's report was spread upon one hundred and twenty-four printed pages as large as TELEPHONE ENGINEER. It is presumed no similar enterprise was ever undertaken. Not least important in the special committee's findings were the several tables of estimates of cost for a second system. The prices were at variance and were placed at $14,983,300 as a minimum and $20,362,750 as a maximum. This report bears date April, 1907. In a city of Chicago's size numerous things are apt to occur in the period of two years. A new estimate would affect these figures.

The prime reason why Chicago has not had a second telephone system has been because independent interests have never been able to make a clean-cut business proposal for the privilege to build. No organization has been found which had the money or could command a sum sufficiently large to take care of the proposition of establishing a second system. There has been a tremendous amount of wasted time. Men have addressed the council, the council committees and the special committees who pretended, with a franchise in their hands, to be able to proceed with the vast enterprise a second system contemplates; but these men, given full credit for sincerity of purpose, always lacked the funds to make their appeals plausible.

The Moses who will install second telephone systems in Chicago or New York will save himself embarrassment by presenting his case from a stage with a setting of real currency and gold. The money will do the talking.

AN IMPORTANT SERIES OF ARTICLES.

THERE appears in this number of TELEPHONE ENGINEER the first of a series of articles on "How to Read Telephone Circuit Diagrams," by David S. Hulfish. This series, when completed, will form the first volume of a five volume work to be entitled "The Telephone Text Book."

These articles will constitute an actual course of instruction in telephone engineering—a work which has never before been attempted in this form. The ambitious telephone worker will appreciate this opportunity to acquire a familiarity with the fundamental requisite of all engineering knowledge—ability to comprehend readily the diagrams and graphic representations of the art.

It has been said that the science of telephone engineering numbers among its devotees a smaller percentage of technically educated men than any other line of work of equally technical requirements; and this in spite of the fact that the text-books which are adapted to its instruction are few. For this reason we believe that there exists a strong demand which this work will supply.

As a telephone engineer of large experience, Mr. Hulfish is peculiarly fitted to handle a work of this character; and its preparation from month to month in serial form will enable him to keep pace with the changing requirements of modern engineering practice.

The Recent Independent Convention

By John R. Marshall

THE twelfth annual convention of the International Independent Telephone Association was held at the Auditorium Hotel, Chicago, December 1, 2 and 3. An attendance of several hundred representatives of independent companies of the United States and Canada was expected, and the registration committee was early enabled to confirm this estimate.

The first actual session was called to order in the banquet hall of the hotel on the morning of the first by Acting President P. C. Holdoegel, of Rockwell City, Iowa. The invocation by the Reverend Frank G. Smith, of Chicago, was followed by an address in which the welcome of the city of Chicago was extended to the independent telephone men by George M. Bagby, assistant corporation counsel of the city administration, acting for Mayor Busse, who was unable to be present. Response was made by H. D. Critchfield, president of the Wisconsin Telephone Association, taking the place of Dwight E. Sapp, of Mt. Vernon, Ohio, who was unable to fill the place accorded him on the program. Mr. Critchfield in no uncertain terms urged upon the city of Chicago consideration of telephone connection with the large number of independent telephone subscribers in the state and vicinity. Joseph B. Ware, of Grand Rapids, Mich., the secretary of the association, made a lengthy and detailed address, and included a comprehensive history of the independent movement during the past year.

The afternoon session was in the nature of a technical and practical conference. This was a departure from the usual custom, inasmuch as the papers read and the discussions treated of practical and engineering problems rather than of the financial problems of independent telephone companies. Representatives from all parts of the United States participated in the discussion, and made recommendations of plans and economical methods to be followed in the maintenance of telephone plants. The technical meetings were in charge of Gansey R. Johnson, of Columbus, Ohio.

The first paper was presented by Roy Owens, of Columbus, Ohio, on "The Telephone Engineer in His Relation to the Telephone Business." This paper stated that the three divisions of telephone engineering are planning, constructing and maintaining, and that it is not uncommon to hear engineers say that they wish to devote themselves to construction and not to maintenance. Some of these are apparently indifferent to the planning. The planning is the really vital part of a telephone engineer's duty. One reason why more plants have not shown the result of poor design is that the demand for telephone service in years past has tended to outrun the capacity of the plants, so that even a poorly laid out cable system has found practically all of its cable pairs called for. As time goes by, however, and subscribers are more difficult to procure, the need of more care in the laying out of the plant will become manifest.

The cable distribution is the most costly part of an engineer's work. A local telephone company may stand or fall with its degree of success in getting cable into those parts of its exchange district where cable will be in demand. The multiple-cable distribution methods somewhat widen the narrower limits within which cable distribution is flexible. The subway and pole lines must be so far complete that there is little demand for their flexibility. The switchboard terminals and the subscribers' lines and instruments have a large degree of flexibility.

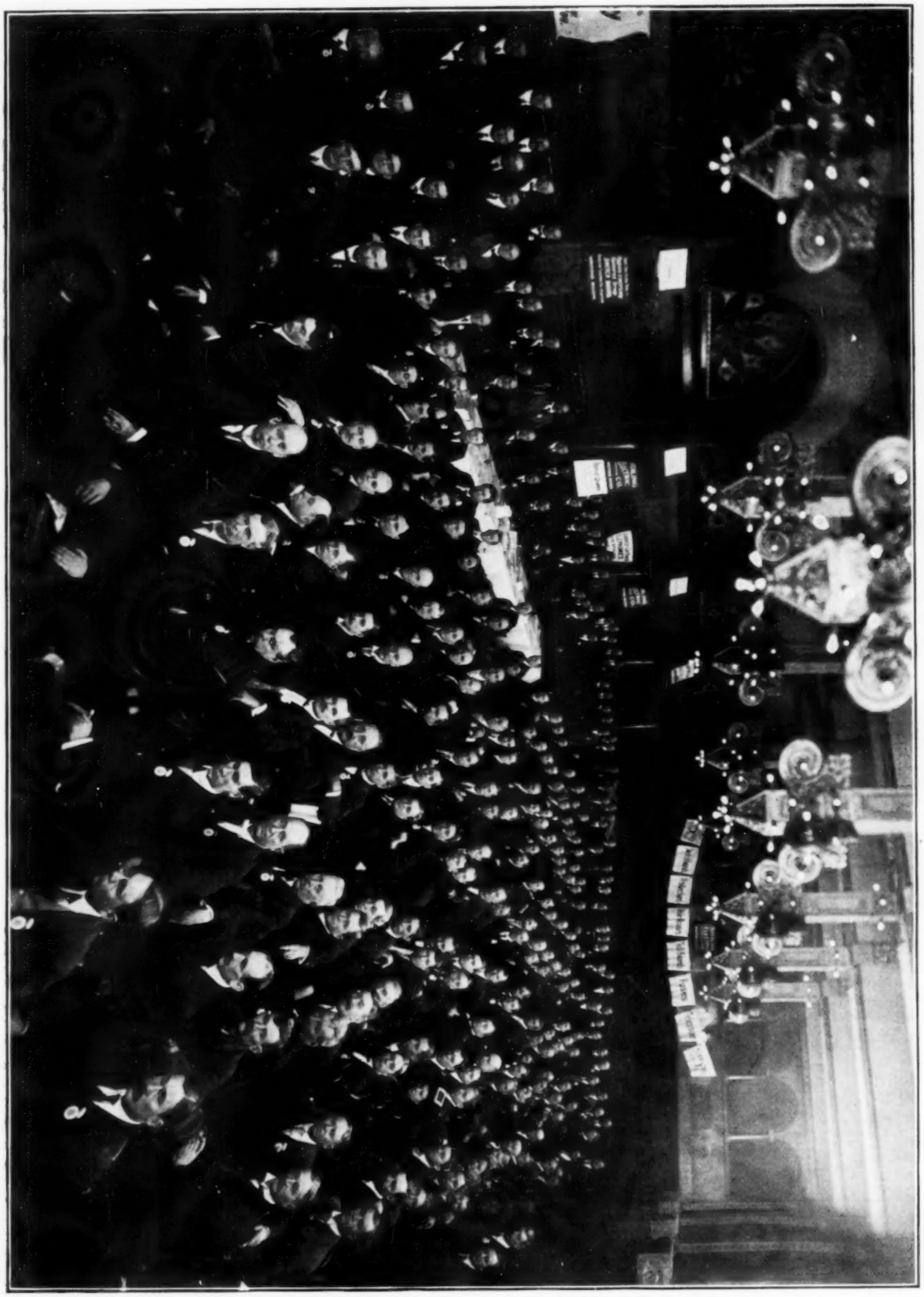
Care should be taken to have the most economical balance between the outside capacity and the switchboard capacity, which means that the former should be somewhat more than the latter.

J. H. Ainsworth, general manager of the Home Telephone Company, Dayton, Ohio, discussed "Some Economies in Handling Maintenance Men." His company has introduced a feature of requiring the repair men to report upon a printed slip whether repairs made are of a permanent or temporary character, as it is not always possible for a single workman to effect repairs of a permanent nature. If the latter is the case, the repairman is instructed to report so, but after the trouble is permanently remedied each man is held to strict account for recurring troubles in his district.

A brief paper read by G. E. Bickley, of Waterloo, Iowa, was entitled "Maintenance Economies." Any reasonable expenditure made to conserve the operation of the equipment, material or apparatus of a telephone system, is an economy, the author said. He also indicated a plan report by postcard of line inspections made in the course of other business, and advised the special inspection of the right-of-way, locating possible prospective troubles by chart.

The paper of J. P. Boylan, of the Home Telephone Company, Detroit, Mich., on "Handling Trouble," was read by B. H. Brooks, chief engineer of the company. Careful tests by operators were advised to forestall the subscriber in the discovery of trouble, and a card system of filing these records was described. In mentioning the difficulty experienced in ringing out on a short-circuited line, the writer described a relay designed to be placed in the generator lead to the position. This relay has an inductive winding shunted by non-inductive resistance. The latter path may be opened by the armature drawing up when an extra amount of current traverses the relay winding. Normally the combined resistances offer low impedance except when the heavy short-circuit current actuates the armature, leaving only the inductive winding in circuit, and lighting a pilot lamp in front of the operator.

Frank F. Fowle, consulting engineer, read an interesting paper on "The Economical Development of Toll Territory," the purpose of which, as the title suggests, was a consideration of the principal factors in building up and developing a toll plant on a dividend-paying basis. There are naturally two divisions of the subject, namely, the projection of an entirely new plant in undeveloped territory and the development of a plant already in existence; but the latter division of the subject grows out of the first, and undeveloped territory will be assumed as the starting point. Were there no previous experience in the toll business to furnish guidance in laying out a new plant in undeveloped territory it would be necessary to proceed with the utmost caution; in fact, the whole development would necessarily be experimental and would involve a large financial risk.



The Convention of the International Independent Telephone Association.

It is found that the public demand for toll service occurs in such ways that certain laws may be formulated which will express mathematically or graphically the volume of message traffic which will occur on the average under any given or known set of conditions. The design of a toll system divides itself naturally, therefore, into two parts, first the predetermination of the traffic, and second the layout of a plant which will provide the necessary facilities in the most economical manner; under the system of rates charged or to be charged it becomes apparent at once what portions of the proposed plant will be profitable at the outset, or, if the rates are not settled in advance, an estimate may be made of the plant charges and the operating costs to handle the traffic, as predetermined, upon which may be based a system of rates which will insure dividends from the outset.

Mr. Fowle had made a special study of the traffic between different cities and towns, based on their population and the distance between them, under a fixed rate. It was found that the traffic volume in total messages per month in both directions between any two zones is well represented by the formula:

$$T = .00022 \frac{P_1 P_2}{D^2}$$

where T is the total messages per month in both directions, P_1 is the population of either zone, P_2 is the population of the other zone and D^2 is the difference between the zone centers, in miles. The range of distances and population in the instances upon which the calculations for the constant were based was very large; no account was taken of the telephone development in the zones used for calculation, but it varied from perhaps 1 per cent, up to 11 or 12 per cent with an average of 6 to 7 per cent.

Mr. Fowle also indicated other formulae for the determination of toll rates, revenue per message, etc., and contributed a quantity of valuable cost and physical data. In connection he exhibited a number of interesting long-distance plant load curves showing the distribution of calls throughout the week, the effect of a night half rate on the service for different days, the relation between speed of service and circuit loads, etc.

Mr. Fowle was asked to explain the action of loading coils on a telephone line. In his reply he commented upon the general fallacy that these coils introduce a condition of resonance into the circuit. On open construction the loading coils are usually placed at the transposition points, about eight miles apart. On cables the distance varies from three-quarters of a mile to one and one-half miles. In some cases their interposition has the effect of increasing the transmission four or five times, but the improvement decreases with the larger conductors.

George K. Gann, Lincoln, Neb., read a paper on "Handling Long-Distance Traffic," describing the two recording methods most generally used and applicable to either large or small offices. These he termed the direct ring-down method and the order wire method. The direct ring-down method requires trunks from the "A" boards in the local offices, terminating at the recording board in signals and jacks. These should be multiplied in each position or section in offices where there are two or more. The method of operation is as follows:

1. The subscriber removes the receiver from the hook, lighting the signal on the "A" or local board.

2. The "A" operator takes one of the cords of an idle pair, plugs into the answering jack of the subscriber's line, and answers "number."

3. The subscriber asks for "long distance."

4. The "A" operator takes the other cord of the pair, tests and plugs into a jack of an idle trunk to the recording board and rings, thus lighting a signal on the same trunk at the recording board.

5. The recording operator takes one of the cords of an idle pair, plugs into the jack of the trunk on which the signal has been received and answers, "long distance." She then secures and records the subscriber's call on a ticket and has it sent or carried to the proper line operator.

The order wire recording method differs from the first in that the trunks to the recording board appear only in the "A" and "B" boards of the principal local exchange. Other local exchanges must secure connection with the recording operator by cutting in on the regular order wire to the principal office "B" board and asking for "long distance." The "B" operator makes a trunk assignment in the usual way, establishing connection with a trunk to the recording board.

The sessions of the convention were continued during Wednesday and Thursday. On Wednesday evening the annual association banquet was held.

The election of officers took place the afternoon of the third and resulted in the following appointments: E. H. Moulton, president; P. C. Holdoegel, first vice-president; E. B. Fisher, second vice-president; J. F. Demers, third vice-president; W. J. Uhl, fourth vice-president; Manford Savage, treasurer; A. C. Davis, secretary. Executive committee, to serve one year: A. E. Boqua, Arkansas; J. W. Barnes, West Virginia; M. L. Golladay, Missouri; I. H. Griswold, New York; E. E. Yaxley, Illinois. To serve two years, F. D. Houck, Pennsylvania; F. G. Hoge, Kentucky; W. H. Nelson, Kansas; J. F. Demers, Canada; H. D. Critchfield, Wisconsin. To serve three years: F. L. Beam, Ohio; Manford Savage, Illinois; J. H. Shoemaker, Iowa; C. S. Norton, Indiana; E. B. Fisher, Michigan.

The following exhibitors occupied hotel rooms or suites with exposition of their products:

American Electric Telephone Company, Chicago; Automatic Electric Company, Chicago; Century Telephone Construction Company, Buffalo; Chicago Telephone Supply Company, Elkhart, Ind.; Cracraft-Leich Electric Company, Genoa, Ill.; H. E. Cobb, Chicago; Frank B. Cook, Chicago; Corwin Telephone Manufacturing Company, Chicago; S. H. Couch Company, Boston; Dean Electric Company, Elyria, Ohio; Duplex Metals Company, New York; Electric Appliance Company, Chicago; Fibre Conduit Company, New York; Fox-Borden Manufacturing Company, New York; H. S. Green Battery Company; Holtzer-Cabot Electric Company, Brookline, Mass.; Illinois Electric Company, Chicago; Indiana Steel & Wire Company, Muncie, Ind.; Manhattan Electrical Supply Company, Chicago; Miller Anchor Company, Norwolk, Ohio; Monarch Telephone Manufacturing Company, Chicago; National Carbon Company, Cleveland; North Electric Company, Cleveland; Ohio Brass Company, Mansfield, Ohio; F. W. Pardee, Chicago; Pierce Specialty Company, Elkhart, Ind.; Homer Roberts Telephone Company, Chicago; St. Louis Malleable Casting Company, St. Louis; Sterling Electric Company, Lafayette, Ind.; Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.; Swedish-American Telephone Company, Chicago.

Restoration of the Paris Exchange

By Willis G. Brandon

"HOW soon can you ship a complete telephone exchange for 10,000 subscribers?"

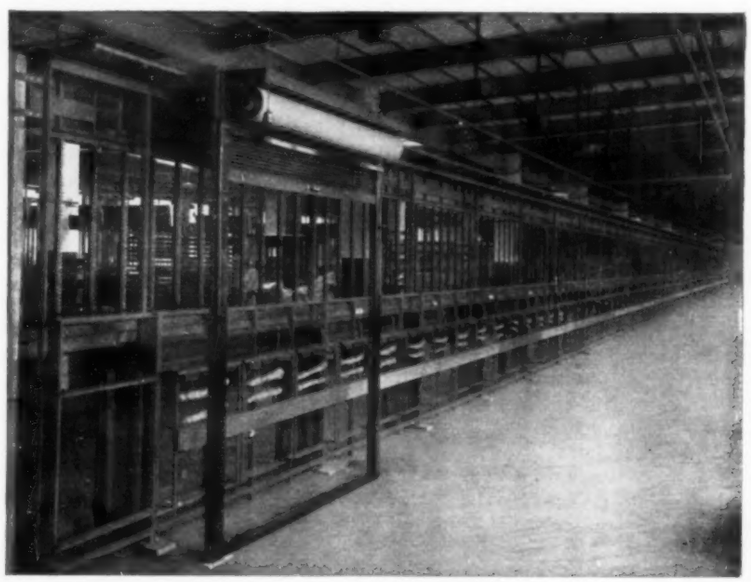
This was the astonishing cablegram as it came to the sales department. Surely there must be some mistake about the size of the order, for who could want a complete telephone system with its myriad of wires and numberless details which go to make up the intricate workings of a modern telephone exchange large enough for a city of 100,000 inhabitants? And, above all, who could want such an extremely large outlay in such a hurry as to inquire by cablegram how soon it could be shipped? No questions were asked about price or quality of material; the all prevailing item was time, time, time.

The Ruined Switchboard.

Every one had read of the big fire in Paris, France, on the night of September 20, in which the great Gutenburg exchange of the Paris Telephone Company had been completely destroyed and the telephone service of 10,000 subscribers cut off without a moment's warning.

Ten years ago it would not have been much of a hardship to 10,000 firms and families to be without telephone service for a few weeks; but in the present day, when we have come to regard the telephone as a necessity rather than a luxury, the removal of its convenience for even a short time causes consternation.

The Gutenburg exchange, situated as it was in the heart of the business district of the great metropolis of France, carried a large proportion of the city's business over its wires. People had become so dependent upon the telephone for the rapid transaction of their business that they were dumfounded when they came to work one morning facing the condition that they would have to resort to the old custom of messenger boys, the mails and the walking-talking methods. In the olden times this system seemed quite satisfactory; but after the telephone had been used in its stead for several years without thought as to its real advantages, to revert back to the primitive methods seemed to put the heretofore unnoticed rush of present day business methods at a standstill. No messenger service could ever take the place of the telephone with any degree of satisfaction. No one realized this more than did the Paris Telephone Company. Its management knew that business in that section of the city would be demoralized until the service could be restored to its normal conditions, and immediately set about making plans for its replacement.



Rear View of the New Board.

The switchboard which was destroyed had been purchased in America; but although the equipment had given satisfactory service, the present demands for an outfit in the shortest possible time seemed to put all American firms entirely out of consideration. It could not be possible that they could even attempt to compete with the firms on the same side of the sea when it came to a matter of rapid delivery.

The American firms were therefore almost forgotten when the company started to look about for some manufacturing company to take its large contract on short notice and guarantee the earliest possible delivery under penalty. It was only after it had had several European firms figuring on the deal that the enormity of the order and the abnormal demands for rapid delivery

were realized. It was soon learned that no manufacturer on that side of the sea would dare enter into such a gigantic undertaking with a time limit less than a matter of months. This was altogether too long to wait, and the officials were about to give up in despair. It began to dawn on them that a large exchange seldom had to be built under such a pressure. Under normal conditions when an operating company perceived that its business was increasing to such an extent that another exchange would soon be necessary to carry the work efficiently, it would lay its plans and make arrangements deliberately, stating its very exacting requirements to the manufacturing companies; emphasizing all the while that the most particular item was good design, quality of material and workmanship, and at the same time a reasonable delivery. The order for the switchboard would probably be placed six months before delivery was actually wanted. But now the conditions were quite different: time was the all important element to be considered. The company would accept the standard type of apparatus providing it could get it soon enough. The fire had caused it a severe loss, but that was not to be compared with the loss it would sustain for each day's delay in restoring service to its customers. As a last resort the management went to the Paris branch house of a large American firm with a feeling that possibly the American factory was large enough to overcome the great distance the goods would have to be shipped by its enormous manufacturing facilities.

The assumption was correct. The American firm had on hand two emergency outfits, each large enough for an exchange of 9,600 subscribers, which were always carried for just such exigencies, one in New York and one in Chicago. Its enormous amount of business enabled it to carry this $100,000 investment in idle equipment for emergency purposes, which no other but an American manufacturer would think of doing.

The Paris branch of the American house offered to have this emergency outfit shipped by the very first steamer leaving New York; but the telephone company decided that it would not pay to install such a large outfit only temporarily.

Negotiations were immediately entered into for the permanent installation. The Paris branch took the matter up with the New York export department; and here we see that first cablegram. After telegraphing the Chicago factory for definite information, New York cabled Paris: "Can ship 10,000 line equipment, if engineering conditions are easy, two months after receiving full information."

September 24, two days later, Paris cabled New York, "Nothing can be done." This seemed to indicate that the American firm was too far away to be of any assistance to the telephone company in solving its problem.

Later the same day the situation took on a different aspect. After translating the next cablegram from the code it read, "What is largest quantity switchboard cable you can send weekly, six weeks?" After communicating with the Chicago factory, New York cabled Paris again, "Can ship 135,000 feet switchboard cable October 7, can ship 1,000,000 feet seven weeks." Paris' reply was, "Ship switchboard cable as per New York cablegram 25th."

The order was telegraphed to Chicago and this lot of 135,000 feet of cable, consisting of four different sizes ranging from 21 to 64 wires to a cable, was packed on 52 reels and started on its journey from Chicago within two days from the receipt of the order.

Although the cable was in stock it was necessary to unreel it and paraffine the ends, then rewind on reels and pack the reels in cases lined with paraffine and tar paper to protect against moisture during the ocean voyage. The cases were also hoop-ironed to further protect them against the rough usage encountered on export shipments.

On September 29 instructions were cabled to build a switchboard of 10,000 line capacity and to hurry the work as much as possible as the Paris branch house of the American firm had contracted for delivery and complete installation of the 10,000 line equipment in two months' time under a penalty of $600 per day.

This order was telephoned to Chicago giving all the details possible at this time. They were very meager to say the least.

The next day, September 30, a cablegram from Paris stated that a standard switchboard would not be satisfactory and added the engineering information under which the board must be built. The branch house also was desirous of impressing upon the minds of those handling the job that all possible haste must be applied to insure an unusually prompt delivery, for the cablegram ended thus: "Do everything you can to ship in one month. Time costs $600 daily."

On October 9, letters dated October 2 were received from Paris stating what was required and giving the necessary engineering specifications. Up to this time the only information received was by cablegram and had been forwarded by the New York export department to the Chicago factory either by telephone or telegraph, each order, of course, being confirmed by letter. With the complete specifications in their hands, however, the engineers could go ahead with assurance that the boards were being built correctly.

In accordance with the Paris branch house request, the racks and frame of the board were shipped first so that it could commence installing. The factory turned out the racks and frame for the complete board in six days' time, shipping them from Chicago October 16.

Under the unusual pressure for time, the Chicago factory promised to ship the switchboard complete on October 24. To make this extremely short delivery it was necessary to work the shop night and day including Sundays.

October 8 work was started with twenty-four men soldering 3,000 jacks per day, but this number was continually increased until on October 23, when the job was completed, there were sixty-five men soldering 25,500 jacks per day. The cable plant was also working overtime to complete its share of the job. At the same time the New York factory was making up about one and one-half carloads of coils and accessories which were needed in installing the board.

The order was shipped complete from Chicago on October 24, the cars arriving in New York at the ship's side ready for unloading at 9:45 a. m., October 27. Special arrangements had been made with all the railroads over which the cars were routed to have them hurried along with all possible speed. The Chicago plant also sent a man along with the goods in order that he might be able to avoid any unnecessary delay in transit. Reservation for space had long before been made with the steamship company, and the nine carloads of material were quickly placed in the hold of the vessel. The New York office then sent a man along to Paris to take charge of the installation of the board.

Within twenty-three days from the time the order

was telephoned to Chicago, the switchboard was shipped complete. This prompt delivery is all the more remarkable from the fact that only enough information was received in the first cablegrams to enable the shop to line up the necessary apparatus.

Additional information in cablegrams on October 3 allowed the engineers to go ahead along the lines which they felt would not be contrary to the requirements of the telephone company. Not until the written specifications were received by the shop on October 10 from the Paris letters dated October 2 were they inclined to put on the utmost speed in manufacture.

There were in all 307,000 jacks soldered and 927,000 soldered connections made. The cabling on the board contains 15,595,859 feet or 2,954 miles of single wire. The finished switchboard is 180 feet in length and will require 90 operators to develop its full service.

It is made in 30 three-position sections, of eight panels each, besides a three-panel section at each end to enable the first and last operators to reach the multiple jacks; a large cable turning section on the right-hand end of the board; and an end panel on the left-hand end.

The engineering difficulties encountered at the outset of the work were enormous. Practically the whole information furnished when the engineering department tackled the problem consisted of an order for an eight-panel, 10,400 jack board. It was not even known whether the restored exchange would occupy its former quarters—or its former building. Then the eight-panel board demanded was a new type; and a complete set of drawings of the board itself had to be made before the shop could do anything on the order.

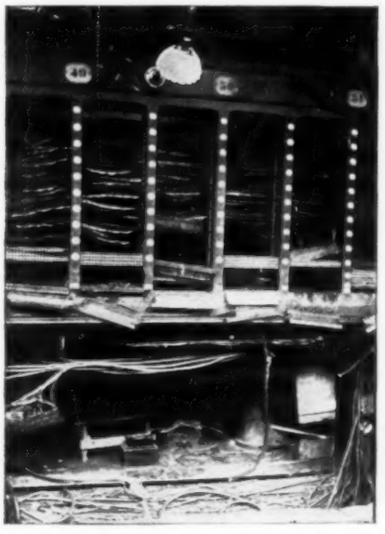
October 2 the first information, incomplete as it was, was whipped into some semblance of form and sent to the shop. October 3 the specifications for the steel switchboard frame were ready; and four days later the frame was finished ready for the woodwork to be assembled upon it.

The board that was destroyed was a magneto type. That explains one reason for the lack of detailed information on the new board. The Paris Telephone Company had decided to seize the opportunity that fate presented to install a central energy system. Obviously, few of the old records were of value in this case.

The first impression was that only the short multiple cables to jacks in the switchboard were to be furnished installed. Later, when half the jacks had been wired and soldered this way, came the information that multiple cables from the board to the intermediate distributing frame were to be supplied. The work done had to be all gone over again, and the cables were figured to drop through a hole in the floor under the cable turning section. After a cable support had been allowed for this run, the report arrived that the frames and switchboard were on the same floor, and cable would come out through the top of the cable turning section.

It was known that the intermediate frame would be parallel to the board. That was all; but based on this meager data the cables were cut and skinned, allowing room enough for a man to pass between the frame and the board. The figuring of these cable lengths was in itself something of a feat, when the information at hand is considered. Racks, also, had to be furnished for these cables to run on.

The Paris Exchange After the Fire.



Effects of the Fire.

In designing the cable run and its support, and the cables between the main and intermediate frames, two curious problems were developed. In the first place, no information was obtainable as to the height of the ceiling in either the operating or terminal room—a very important bit of information for the engineer. The only available source of knowledge was a man who had once seen the Paris exchange. He guessed the height to be 10 feet 6 inches. Then a sketch of the floor arrived from Paris, and showed, between the frames, a number of beams or channel irons. How they were located, and why they were there, did not appear. To avoid them, a construction was adopted that permitted the whole apparatus to be shifted endways in installing enough to clear the possible obstructions.

Nothing was known as to toll equipment, key shelves, circuits, or provision for outgoing trunks. The catch phrase of the engineering department became "we infer." It speaks well indeed for the organization that the inferences proved 90 per cent correct when the information did arrive.

The board was built of solid mahogany; but nothing

was said of finish. To be on the safe side, the European piano finish was adopted—which meant just 10 days longer in the shop than if the dull finish had been used.

Besides the switchboard, an intermediate distributing frame with a capacity of 11,000 lines, and a relay rack of the same size were furnished. With the latter went approximately 15,000 relays for rack and board. Even a part of the machines were supplied.

Here is a curious development of the order. All apparatus liable to be damaged or lost in shipment or installation was duplicated, down to the last screw; for the latter are especially hard to replace in Europe, screw thread standards being different. All dimensions of the board, in fact, were given out by Paris in millimeters.

To meet shipping conditions, the board had to be made in such shape that it could be "knocked down," packed, and reassembled in Paris.

The Paris fire is a good argument against having all one's eggs in one basket. The emergency outfits carried by the manufacturer would be sufficient for the immediate restoration of any American exchange, for the reason that large telephone systems in this country are subdivided, and destruction of one exchange simply throws extra work upon the others until repairs can be made. One board 90 positions long is an unusual condition to meet.

How to Read Telephone Circuit Diagrams

By David S. Hulfish

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LESSON I.

ALL OF our written languages began with picture writing. The earlier languages gradually transformed those pictures into symbols more easily and therefore more quickly written.

The transformation came principally through the laziness of the writing person, who continually would simplify the more complex forms of symbols or pictures in an effort to accomplish a result with the expenditure of the minimum amount of labor.

Coincident with these simplifications from the standpoint of the writing person came a benefit to the reading person, since the simpler symbols were as easily read at any time, and far more easily read than the more complex ones when made with little or no care.

The telephone circuit diagram has a language all its own. That this language is worthy of consideration as a language in itself is a statement quite in harmony with the history of the development of the language of diagrams, when studied comparatively with the history of the different written languages of the peoples of the globe.

It is a simple language when approached in a spirit of reverence. It is quickly mastered when intelligently and painstakingly studied. To he, however, who rushes unprepared into the task of deciphering an intricate circuit drawing, the barbed wire entanglements of a military defense thereafter will have no terrors.

Confusion to the reader of a circuit diagram may result from a lack of skill on the part of the maker of the diagram. A lack of skill will be disclosed most plainly by the use of new and eccentric symbols for parts of apparatus instead of the generally accepted and widely known symbols. One unfamiliar with the accepted symbols may originate a symbol so unlike anything theretofore used that his symbol appears at first unintelligible. In such a case the meaning of the different symbols, and of the complete diagram, may be deciphered through a knowledge of the principles through which the accepted symbols have been developed.

The student will be helped by observing the general rule that each symbol used in the telephone circuit diagrams of the present day was originally a picture of the unit of apparatus represented, or of a vital or distinctive part thereof. This is not a rule to be taken without exception, but it is almost universally true for symbols representing detached units of apparatus. The modifications, however, which have been placed upon these original pictures sometimes so obscure the original as almost to take away its identity, and the different viewpoints which may be taken for a single unit of apparatus sometimes are so numerous as to lead to confusion.

The rule may be recited, that a symbol is a picture simplified to make it easier to write or draw.

Acquaintance with the mechanism itself is of value in reading the symbols of a telephone circuit diagram. An acquaintance with the principle of operation is necessary, and knowledge of detailed construction may be required in some instances. As a general rule, however, any specialization of construction of a standard part of apparatus is indicated in some way in the diagram, or the variation is explained by supplementary illustration. The specialization may be indicated definitely and completely, or it may be merely suggested, making necessary a study of the remaining parts of the diagram to determine what will be required of the modified unit before the reader may determine what the modifications of the unit are, or in what manner its required functions are attained.

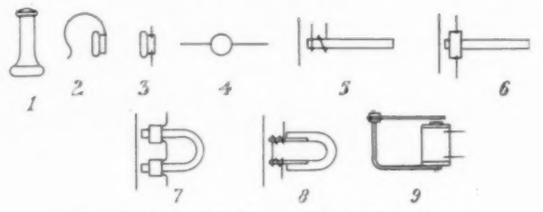
The general rule for making a telephone circuit diagram is to locate upon the page a symbol for each of the units of apparatus, and then to connect the conducting parts of those symbols with lines representing conductors or wires. The location of the symbols upon the page is in general immaterial, since the electrical relation usually is shown rather than the mechanical relation; this, however, leads to a subject for later consideration, viz.: the combination of mechanical details with the electrical details of a circuit diagram.

Those telephone circuit diagrams which are confined substantially to electrical details may be divided into two classes. The basis of division may be either the minuteness of detail, or the purpose to which they are to be put.

First for consideration is that class of circuit diagrams known as "wiring diagrams." Diagrams of this class are intended primarily for use in enabling workmen to connect the electrical circuit wires running between the different parts when the telephone system or apparatus is being constructed. In such a diagram the various mechanical parts necessarily are shown in sufficient detail to enable the workman to identify the different term-

inals of each part upon the part itself, merely by reference to the wiring diagram; the workman then proceeding to connect the indicated terminals by circuit wires as shown in the wiring diagram, thus completing the structure. Such diagrams, however, usually show each of the parts of apparatus in such degree of detail as to enable the operation of each part to be noted, and thus the entire circuits of the structure may be learned from the wiring diagram and the structure as a whole may be understood from it.

In addition to service for the construction of the

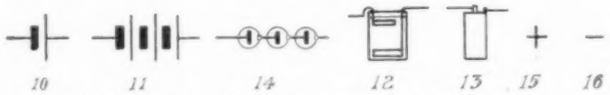


Figs. 1 to 9. Symbols for Telephone Receivers.

telephone apparatus, the wiring diagram is a necessity in the operation and maintenance of the apparatus, enabling faults to be located and repairs to be made with facility.

It would seem, therefore, that the wiring diagram fulfills all of the requirements of any telephone circuit diagram so far as electrical conditions are concerned, since it enables the apparatus to be constructed, maintained and understood thoroughly. Its single fault is that it is complex. For this reason alone a second class of circuit diagrams exists.

The second class comprises simplified circuit diagrams, and these are known as "simplified," "schematic" or "skeleton" diagrams. They set forth the electrical details only, and show those as simply as possible. In the



Figs. 10 to 16. Electric Batteries in Symbolic Form.

symbols the greatest simplification is desirable, and the lines connecting the various parts are to be interpreted as representing electrical conductors rather than wires in any part of the system. A single line upon a "schematic" diagram may correspond to several wires in the wiring diagram and in the physical apparatus, or merely to a conducting structural part in the apparatus. The object of the skeleton diagram is to offer a synopsis of the detailed wiring diagram in order that the nature of the system, its object and its means of accomplishment may be grasped readily by a reader to whom the entire circuit matter is new. The skeleton circuit therefore offers a condensed and easily read synopsis of the complete circuit, and for most purposes is preferable to the more complex diagram. In addition, it offers a key to the more complex diagram and enables it to be more quickly and intelligently studied.

It is customary to accompany a complex detailed circuit or wiring diagram by a small skeleton diagram of the same subject. In many instances the study of the small diagram will be found sufficient for the reader's purpose, and if it is not so, then that particular portion of the detailed diagram involved may be studied.

A very good conception of the relations of the two types of diagrams when thus used jointly is to regard the detailed diagram as a book of information to which the skeleton diagram is the index or key.

The first requirement of the reader of telephone circuit diagrams is the ability to recognize the more common pieces of apparatus by their symbols, and for the acquirement of skill by the student in this direction the more common pieces of telephone apparatus will be taken up in order.

The telephone receiver as used by the public at the present day appears in containing cases of distinctive types, and pictorial representations of typical receiver cases are widely used as symbols for receivers. The types most commonly used are those of Fig. 1 and Fig. 2. When Fig. 1 is supplied with surface shading it becomes a picture; without the shading it is merely a symbol of the type of receiver usually used at substation telephones. Fig. 2 represents an operator's receiver, with head band. Fig. 3 also represents the operator's receiver, or "watch case" receiver, but without the head band. Fig. 4 represents a face view of the receiver, either of the subscriber's type of Fig. 1, or the operator's type of Figs. 2 and 3. Fig. 4 is a symbol which requires "context," or the assistance of associated parts of the diagram, to enable its meaning to be determined; but when we find a

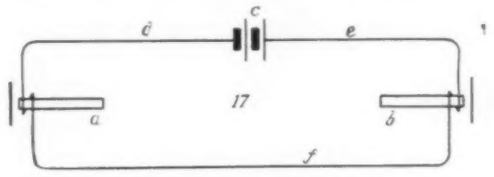
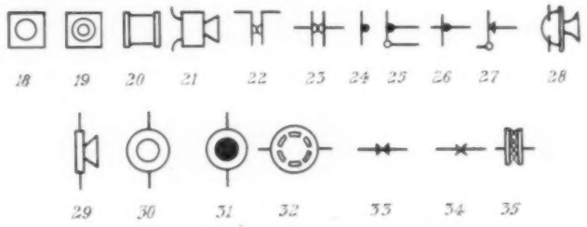


Fig. 17. A Simple Telephone Circuit Diagram.

simple transmitter symbol, a simple induction coil symbol and the symbol of Fig. 4, properly associated with connecting wires, it will be clear to the reader from the association that Fig. 4 represents a receiver, either a face view or a rear view, of a watch case type.

The original telephone, which was used as both transmitter and receiver, comprised an electromagnet mounted on end within a cup-like wooden box and reaching near the top of the box. A sheetiron diaphragm was laid over the top of the box and served at once as a diaphragm for the telephone and as a cover for the box. This device was substantially a rod of iron with a wire wound around it a few times, in combination with a disc of sheet iron held mechanically over the end of the rod, but not touching it. All of the electrical features are represented or pictured in the simple diagram or symbol of



Figs. 18 to 35. Transmitter Symbols.

Fig. 5, which is a common symbol for any receiver or magneto transmitter. In this symbol no note is taken of any mechanical detail of the piece of apparatus, its electrical features alone being noted in diagrammatic form. Fig. 6 shows a modification of the symbol of Fig. 5, a spool of wire being shown instead of the few turns shown in Fig. 5.

In the very earliest days of the telephone the device was modified to bring both poles of the magnet to bear near the diaphragm, giving the type symbolized in Fig. 7 and Fig. 8, both of which symbols are found in the early literature of the art. Fig. 8 shows a construction presumably having a permanent magnet. The symbol of Fig. 9 also represents a receiver or magneto telephone, and is of interest as being the symbol used by the inventor, Alexander Graham Bell, in the first telephone patent ever issued.

In this set of symbols for the receiver, Fig. 4 should be noted as being the ultimate reduction of the pictorial idea, and Fig. 5 as being the ultimate reduction of the diagram of vital parts, both of these symbols being reduced to a point of great simplicity and ease of drawing. Fig. 1 is the preferable symbol.

The accepted symbol for a battery cell is that shown in Fig. 10, and no symbol is more generally or uniformly used. To represent a battery of a number of cells the symbol is repeated as shown in Fig. 11, which shows three cells in series. The number of symbols thus written into one battery need not correspond to the exact number of cells intended to be represented, hence the voltage of a battery cannot be estimated by the symbol alone. This follows also because the symbol (Fig. 10) is used for any type of battery, while the potential of the different types of batteries vary, a gravity cell being about one volt, a dry cell about one and one-half volts, and a storage cell about two volts. The symbol for a battery therefore does not determine the potential definitely, but where two batteries, which necessarily are different in potential, are included in the same diagram the higher potential should be shown by a greater number of symbols than the lower, thus disclosing the relative potentials of the two.

Other battery symbols are shown in Fig. 12, which represents a gravity cell; Fig. 13, which represents the side of a dry cell, and Fig. 14, which represents a top view of three dry cells connected. These symbols are rare, but may be taken as types of exceptions.

The polarity of a battery represented by a symbol where the polarity is not marked is a point not decided by custom. A few manufacturers and operating telephone companies have adopted a rule for their own use, but inasmuch as these standards differ, it may be said generally that no standard has been set as yet.

The development of the battery symbol does not help in the matter of settling the question of a standard symbol expressing polarity as well as potential. The development of the symbol of Fig. 10 is not authoritatively known, but it may be assumed to have its origin in a picture. If, now, the gravity cell of Fig. 12 were taken as the prototype of Fig. 10, the shorter of the two elements of Fig. 10 would represent the shorter of the two elements of Fig, 12, namely, the upper or zinc element; this fixes the shorter element as being of negative polarity. Note, however, how closely the short element of Fig. 10 corresponds to the middle or carbon element of the cells of Fig. 14, which is the positive element of the cell; furthermore, the short element of Fig. 10 usually is made heavy and black, and carbon is black and carbon is positive; this argument fixes the shorter element of Fig. 10 as being of positive polarity.

In making a diagram the maker may determine his polarities and adhere to his own law. It is well that he should do so. In reading a diagram, however, the polarities have been determined by the maker of the diagram if they have been considered at all, and the reader must accept what is set before him.

In diagrams where the polarities are essential, the polarity signs, Fig. 15 for plus or positive and Fig. 16 for minus or negative, should be set adjacent to the end elements of the row of battery symbols. The indication of the polarity of the battery is done almost invariably in wiring diagrams, and but seldom in skeleton diagrams.

A knowledge of the diagrams thus far studied will enable the student now to read a simple circuit, such as that of Fig. 17.

For ready reference to different parts of a diagram, letters or numerals are placed upon the page adjacent to the various parts of the diagram. These are called "reference letters," "reference numerals," or "labels," and are used to represent the symbols in the text. Thus, in Fig. 17, we have the telephone *a* and the telephone *b*, connected with the battery *c* by means of wires or conductors *d*, *e* and *f*. The circuit of the diagram is read, "the circuit *c*, *e*, *b*, *f*, *a*, *d*." This is the original telephone circuit, the battery *c* acting through the windings of the two telephones to produce the magnetism necessary for speech transmission. The two telephones were used both as receivers and transmitters, so that the circuit shown is complete for talking purposes.

The variable resistance transmitter has its full quota of picture symbols representing the containing case of the transmitter. The earlier transmitters were inclosed in wooden boxes, and from this type of case we have the symbols of Figs. 18 and 19, representing front views of a box with a funnel-shaped opening behind which the diaphragm is mounted; also Figs. 20 and 21, which are side views of the same device. The connecting wires are run into these symbols in any way convenient when drawing the diagram of which they form a part.

The earliest type of variable resistance transmitter to come into wide use consisted of a single contact between two points, one of carbon and one of platinum. In Figs. 22 and 23 we have a symbol constituting a drawing of this vital feature of the transmitter. It is shown twice to illustrate the two methods of connecting the conductors of the diagram to the symbol, the symbol itself comprising merely two parallel lines with osculating projections.

Since the principal features of a variable resistance carbon transmitter are the diaphragm and the carbon button located approximately against the center of the diaphragm, we come logically to the most generally known and most widely used of all transmitter symbols, that of Fig. 24. Conductors are led to this symbol in several ways, Fig. 25 representing the conductors connected to the carbon element and to the edge of the diaphragm, and Fig. 26 showing them connected to the two sides of the carbon element, or to the carbon element and to the center of the diaphragm, as one chooses to consider it. Fig. 26 is the symbol most generally used, and it is the easiest to draw. A modification is shown in Fig. 27.

Originating as picture symbols of the familiar round metal transmitter cases, we have Figs. 28 and 29, representing side views and Figs. 30 and 31 representing front views.

Fig. 32 is a specialized transmitter, the pictorial symbol for which is so eccentric that the context of the diagram would be necessary to identify it as a transmitter. Eccentric symbols typifying the resistance only are shown in Figs. 33, 34 and 35.

(To be continued.)

Some Questions Answered

By J. C. Kelsey

WHEN I was first consulted regarding the possibility of my handling a query department for TELEPHONE ENGINEER, I suggested that I was "rusty" and, besides, it was hardly probable that anyone would believe it logical that a newly baptized magazine could start out with a full-fledged inquiry column; hence, I am using questions which have recently come up in a personal way. The reader is accordingly warned.

As the fundamental idea underlying this magazine is competition, I want my department to share the joys and sorrows incidental to such a platform.

Competition is the life of trade. Nothing new about that, but there are also countless souls who could testify that competition is the death of trade. Such competition, however, is of a cut-throat nature and is not the kind we need every day.

Two great railroad systems watch each other's movements closely. When one company builds a depot, the other one does. When one issues $30,000,000 improvement bonds, the other one does the same thing, whether needed or not. One company adopted a sleeping car. The other followed suit and came back with a dining car. Then one put on a nineteen-hour service and the other came back with an eighteen-hour service. The public has no gratitude and is like a family cat that will desert an old home because a neighbor has a warmer fire and a more comfortable rug. So the company which gives best service for the money gets the business. This certainly applies to the telephone companies.

Morals are on a competitive basis. When a crusade for good is completed in one large city all other large cities are benefited. When one municipality brags of a low crime rate as the result of Sunday saloon closing, other cities soon follow and make other improvements, which lower death rates, improve street cars and electric light service and make life more safe and agreeable all around.

Many a common battery telephone system has been installed, because your subscribers have gone to other cities and found out that subscribers could get central by simply removing the receiver. They came home and told about it and you were obliged to make the change. Ten to one it has benefited you.

Our city has 10,000 people and our telephone exchange claims to connect with 1,400 subscribers. As is usual with telephone plants in cities of this size, there have been several attempts to reconstruct the plant, and at present the company has considerable underground cable and 80 per cent of the overhead construction in cable. It has a comparatively new common battery switchboard. Nearly $100 dollars per station has been put into the plant. The old rates were $24 and $12, but now it is proposed to raise our rates. The company is asking $36 for single line business; $24 for single line residence and $18 for four-party residence service. What does it cost to operate an exchange of this size and condition in localities other than this? We are planning considerable opposition and would like an expression from you.—W. A. H.

That the company is meeting with considerable opposition is to be expected. Raising the price of any commodity usually makes trouble, unless it happens to be oil or meat.

The telephone rate is particularly sensitive to disturbance of public minds, since cost charges for service are not fully understood. One estimable professor of political economy in a big eastern university once admitted that the question of telephone rates was beyond him. It has ever been puzzling to me how anyone but a railroad man can fully understand railroad rates, and likewise a telephone man understand telephone rates.

The completed telephone call is the unit of the system. It has practically a fixed cost of production. When your company had two hundred subscribers, your people had a limited range of action, and after their original curiosity died out, they called each other a certain but lesser number of times daily.

Take yourself for instance. When the company had 200 subscribers, you called your acquaintances, or business associates, within that circle of 200. When farm lines were built and your farms were connected, you had a new place to use a telephone and so did your farm people. Then your friends took to the telephone and you had a more extended use of your telephone. And so has your wife. She calls her friends. She calls the Ladies' Aid Society together; and your children also use the instrument quite extensively.

When there were but 200 telephones, they were principally business stations, and were used only when necessary. When the system reached 1,400 telephone stations, the activities of the telephone became more and more apparent, not only to business service, but to all social and personal affairs.

So if a completed connection has a fixed charge, it is costing the company more to operate, since not only yourself but everyone else is making more use of the service.

Getting down to practice, it is costing from $6 per station in small towns to $20 per station in large cities using 30,000 telephones. This is the actual cost of operating and maintaining and does not include depreciation, or renewal charges, or interest upon investment.

The average costs go to show that your telephone company cannot operate much under $13 per station. This amount will pay all operating salaries and current maintenance charges and keep the present plant in ordinarily good repair.

The next item to be considered is a fair renewal reserve charge. The least figure possible is $4 per telephone per year. This makes the total cost $17 a year and leaves the dividend or interest upon the investment to be provided. The subscriber helps to wear out the system, and he should pay his share.

The company should be able to carry on current repairs and take care of all current expense items on $13; but there is a renewal feature, outside of current repairs, that we cannot get away from.

Most telephone companies, contemplating new switchboards and improved construction, find that $4 per year per telephone will provide plenty of money to make the desired improvements, without increase of capital. Besides, the possibility for lowering current repair and other expenses is provided.

The last item of the three general ones is interest on investment, or dividends. Public service enterprises are certainly entitled to a high dividend rate, since there

is ever a peril, not only of destruction to plant from the elements, but from danger of legal tangles which vex every corporation. Companies are sued on every pretext and have no protective fund except out of current earnings. Consequently, the earning rate should not be under 10 per cent. Not that 10 per cent should be paid, but that a surplus fund could be maintained to meet unusual demands and never at any time allow the dividend rate to be changed or reduced. A cessation of dividends work havoc with the average investor, and it also works havoc with the sale of securities.

As to the investment of $100 per station, the question arises if this amount is justifiable. In cities of this size, there is ever a peculiar situation. The original genius who foresaw the possibilities of a telephone plant was a man of small means; but he started and put in what money he could find, and he used all the credit the manufacturer would extend to him. He naturally built flimsily and adopted false economy; but he struggled on, and when he reached about seven hundred telephones he found that he had to run cable over his small pole leads.

Up to this point the $2 rate was sufficient, for it gave him money with which to carry out the demands for service. Then he arrived at the stage where his plant was not only inefficient, but obsolete. He tried to raise more money and found that he was "up against it." But he did find some one willing to buy—a company willing to pay him $30,000—just what money he had put into the plant.

The new company then proceeded to build—to reach out into the scattered districts, and to connect all the people who for several years had despaired of service.

The new company paid $45 per station for the old plant, but simply had to scrap it. It is easy to see that a nice new building and a lot in a city, together with underground and all cable overhead, will foot up to $75 per station.

The question is, can the new company capitalize the old junk? Why is it justified in charging the people for an old worn out plant? Why allow the company to capitalize the errors of the first management? The errors of the first management were designed to be economic, but no previous experience had guided it. It was justified on the ground that the old rates of $2 for business and $1 for residence was not sufficient to create a renewal reserve fund to replace the worn out plant. Consequently, the public in the past did not pay its share of the destruction, and the only way to get partially even would be to tack it on to the capital, and obtain the interest on destruction, even though the destruction account will never be paid by the public.

The new plant management is trying to make the public pay into a renewal reserve fund, and the least amount to be considered is $4 yearly. Therefore, the cost of operating and maintaining a first-class, up-to-date plant in a city of 10,000 people and 1,400 subscribers is:

$13.00	for current operation,
4.00	for renewal reserve,
10.00	for interest purposes, or
$27.00	for total expense.

Accordingly, if $27 is the average cost charge of furnishing a telephone in the city, let us see if the proposed rates will be sufficient. Practically, the average income of the company will be:

40 per cent of $36.00	= $14.40.
60 per cent of 18.00	= 10.80.
100 per cent	= $25.20.

This will hardly be sufficient, for it provides only 8 per cent upon the investment.

There is this feature, that the company will have a toll terminal value and that would have at least a net value of $2 per local telephone station. This would make up the average cost of $27.

It is barely possible, with good toll connections, that the rate of $33 for business might be more reasonable at the present day; but the subscriber list is by no means full. There still remains a possibility of 1,800 subscribers, and then the $36 rate would be fully justified.

When you are in trouble call upon your friends. How does that sound? Well, I have this proposition and will give it to you.

We have a lead from Adel, north, on which we have three grounded farm lines, numbered 2, 18, 20 and 21. No. 2 runs from Adel to Dallas Center, a distance of eight miles, it being five miles north and three miles east. On this line there are ten telephones between Adel and Dallas. No. 18 runs from Adel to Minburn, ten miles, with no telephones on between. No. 20 runs five miles north, thence west three miles and thence south, and has seven telephones on the line, but none between Adel and a point five miles north and three west. No. 21 runs north three miles and has two bridges and three telephones.

Now, the light people have a lead from Adel to county farm at the same point that our No. 21 end goes north. For the first mile the light lead is on the opposite side of the road; then it is on the same side for a mile; then on opposite side for half a mile, and then back again. We are on 25-foot and the light lead is on 30-foot poles. Wires all in the clear.

The light people have two machines. No. 1 is 75 kilowatt, 60 cycle, 7,200 alternating, 2,200 volt, 900 revolutions per minute, revolving field type. No. 2 is 50 kilowatt, 60 cycle, 7,200 alternating, 2,200 volts, 900 revolutions per minute, revolving armature. Both machines have frames grounded. No. 2 was a 1,100 volt machine and has been rewound to 2,200.

When No. 1 machine is in use, from noon till midnight, the farm lines are not bad, remaining normal; but when No. 2 machine is running, from midnight till noon, it practically puts our rural lines out of commission. Our exchange telephones on returns are a trifle noisy on machine No. 2. It makes no difference if you take the ground off the machines or not. I have made tests but find nothing. It is evident that it is in the machine, but where?

On line No. 2 when machine No. 2 is running, a Weston voltmeter, type 45, with no battery in circuit, the needle will go to about five degrees on low scale and at times steady, then will quiver. With machine No. 1, the needle will never go over two degrees. The noise is very bad on machine No. 2 and a number of times, has dropped off till it was what I would call normal. It sounds like 60 cycle harmonic when rung in your receiver.

At the power house the leads come to four double pole, double throw switches, machine No. 1 to upper brushes and No. 2 to lower brushes. Wiring from switchboard to machine go through tubes and are O. K., so far as I can see. We have never been troubled till within the past two weeks.

I tested machine No. 2 brushes and found them exactly the same. I then touched a ground to either side and put ground on one side of voltmeter and tested to each brush. I tested with machine frame grounded and off and in all tests found no deflection to ground. On the rural lines No. 2 line is the worst, being the one that has telephones all along the line.

Can you tell me what is the matter? Don't tell me simply to metallic my lines, for I know that. I may call on you again next month. If not taking too much of your time, I wish you would give me some reason for machine No. 2 acting as it does and why it affects only a few lines when I have twenty-four others. Would the inductive field offered by lines running as they do not affect them even if a ground existed in town?—S. E. C., Iowa.

Unfortunately your inquiry came too late to enable me to include the diagrams in this first number of Tele-

PHONE ENGINEER, but little things like that will be overcome as we get older. However, you are not going to be told to make your lines metallic. With a well-balanced lighting circuit, a grounded telephone line encounters no trouble.

Since this trouble appeared, two weeks ago, there can be one particular thing suspected, that is, a leak or partial ground, or good ground on the lighting circuit.

The symptoms indicate that machine No. 2 is your trouble maker. Machine No. 2 is a rewound machine, and the chances are that its wave form is considerably different from the wave form of machine No. 1, and will give a much more decided note in the field of its inductive disturbances.

On your voltmeter test you find a reading from both machines which goes to indicate a state of electrostatic strain. While you get a greater reading from operation of machine No. 2, that is due to above suggested sharper wave form.

An electrostatic stress or strain can come from a parallel lighting system only when one side of the circuit is grounded. In Indiana the telephone lines were put out of business when the alternating trolley systems began operation. The alternating system puts a 3,300-volt pressure on the trolley and makes use of the earth or rail as a return. You may imagine that troubles come to the telephone people. If the telephone line is too well insulated a charge exists on the line, like the Leyden jar of your school days, and the first person giving this charge a chance to leak to earth needs a doctor. If the line is not well insulated then the unequally leaking earth seeking charges go to earth and noises are painfully apparent.

In the case at hand one side of the alternating circuit is grounded. This makes the other side act as an alternating trolley wire does and your most susceptible lines show noise first. If the ground were one without resistance then your trolley acting wire would force the full pressure effects of 2,200 volts and make your metallic lines noisy.

As it is, possibly the ground is partial and 2,200 volts is not fully exerted, but enough is exerted to make your grounded lines noisy. Your tests have not been made upon the power lines themselves. Get permission to pull the switch and ring on the lines for a ground test. You will find one, or I'm mistaken.

I have made a test upon such condition with a volt meter. Connecting to ground first, through a volt meter, the attendant pulled the switch. I tapped the wire to the switch and found a reading of 15 volts of earth current showing in the volt meter. As the affected and noisy telephone lines paralleled both the trolley and the power leads, I knew that we had the trouble located.

The average ordinary track shows 10 volts to the mile, and we found a real ground on the power wires just one and one-half miles from the power house.

So I take a chance judgment that neither No. 1 or No. 2 machine are defective, but that a ground has developed upon one side of the lighting circuit.

It is to the interest of the lighting company to hunt the ground, because the general insulation of the system has been halved and grounds will tend to appear on the other side of the line and result in a short circuit.

I have ever insisted that electrostatic potentials are the hard ones to counteract. Generally cases of this kind are accidental, but the introduction of permanent, grounded, alternating conditions have changed the lamp, as it were, and no remedy has yet been found. Take it from me that your trouble is due to some line unbalanced on the electric lighting company's wire.

The Installation and Protection of Telephones for Electric Railway Service

By Frank F. Fowle

THE use of the telephone for train dispatching and general communication on interurban electric roads is now almost universal. The practices which have grown up under such use are naturally varied according to local conditions and individual needs. The methods of communicating with train crews require the use either of portable or stationary types of telephone set, in conjunction with a transposed metallic circuit extending from the dispatcher's office or the private exchange switchboard to the end of each operating division. Portable sets are intended for transportation upon trains, connection with the line being secured by means of cut-in or so-called jack boxes. These boxes are installed periodically along the road at mile or half-mile intervals and at station stops, at sidings on single track and at junctions, and have permanent connection with the telephone circuit. The portable type of set is provided with a cord and a device for connecting with the stationary boxes. Sometimes the box is equipped with a plug, and the portable set with a jack concealed in a hollow handle which slips over the plug and is connected to the end of the cord. The more common arrangement is a jack in the stationary box and a plug connected to the cord of the portable set. No protective device is now commonly used in these boxes containing jacks or plugs.

Another method of securing connection with the line is by means of a so-called "fishpole," which is equipped with one and, sometimes, two contacts for engaging the line wires. This device is generally made in sections for convenient transportation, and equipped with metal joints and a considerable length of flexible conducting cord.

When portable telephone sets are not used, or if carried are employed only in emergencies, stationary sets are installed at all points at which trainmen will have daily or occasional need of communication with the dispatcher or the trainmaster. Such telephones are installed in a large variety of ways, sometimes protected, but often not; they are used occasionally in conjunction with semaphore train order signals which are under the direct control of the train dispatcher, for the purpose of stopping trains for orders. The telephone line itself is of well known construction and needs no description; the important feature in regard to it is the choice of the material and the gage of wire, which together give the desired

volume of transmission for the smallest annual cost, in interest, depreciation, maintenance and taxes.

PORTABLE VS. STATIONARY TELEPHONES.

The question in any given instance of whether portable or stationary types of set should be adopted is affected by numerous considerations, among which the following are important:

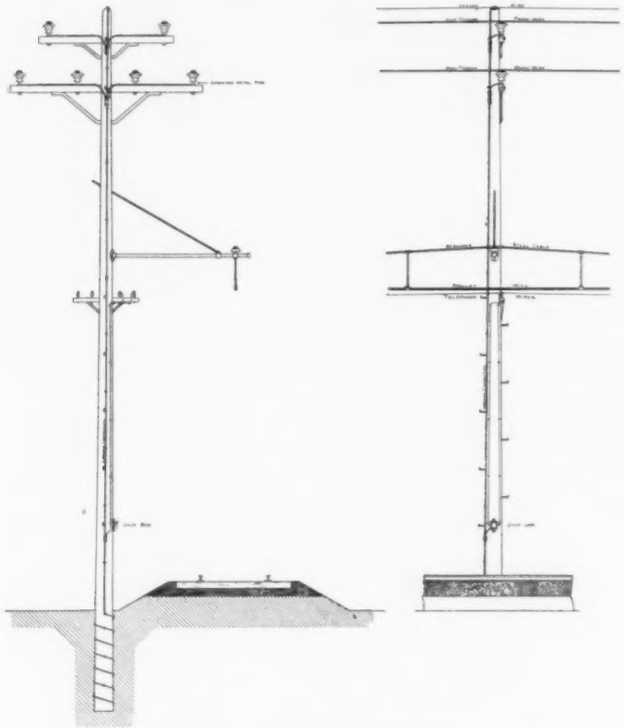


Fig. 1. Jack Box Installed on Pole.

1. Length of road.
2. Single or double track.
3. Frequency of schedule train service.
4. Frequency of irregular or extra train service.
5. Use of automatic or manual block signals.
6. Number of train registry offices and points at which train crews must report to the dispatcher.

These six elements are factors in determining the probable amount of use of the telephone for transmitting train orders and reports. On long roads with infrequent train service and few extra trains, it will usually be the case that the cost of telephone equipment will be a minimum if portable sets and jack boxes are adopted; the first cost of a portable set is not materially different from the cost of a stationary set, usually a trifle less, and the cost of a jack box is only a fractional part of the cost of a set. A typical jack box installation is illustrated in Fig. 1. The chief advantage of portable sets for exclusive use is economy in first cost. The design of a compact, light, portable set with a full complement of telephone equipment is a very difficult matter, and some compromise between weight or cumbersomeness and the amount of equipment is often necessary. Opinions differ, moreover, as to what constitutes the best compromise. Telephones for railway service are commonly subjected to rough handling, and are therefore more ruggedly built than the ordinary telephone; hence a substantial portable set with a full complement of equipment and batteries is very likely to be heavy and cumbersome. The battery cannot be done away with, because common-battery working on long open wire lines is impracticable. Portable sets are commonly carried in the motorman's vestibule or compartment. In case the poles along the road are located near enough to the tracks so that the motorman can plug into a jack box without leaving his car, the use of portable sets is much facilitated, and some of the objections to them disappear. In most cases, however, it is necessary for the crew to leave their train to plug into a jack box, and then there are the following objections to portable sets:

1. The set becomes a physical burden when used frequently.
2. No privacy is possible, and passengers may overhear orders and reports.
3. In stormy weather the crew is wholly exposed while using the telephone, and naturally will make a minimum use of it.
4. When a train has just arrived at a meeting or passing point in stormy weather, and the opposing or superior train is late, the crew may delay using the portable set in the hope that the other train will arrive in a few moments, whereas they may be losing time in case the dispatcher has orders for them to proceed.

The following objections refer to portable sets in general:

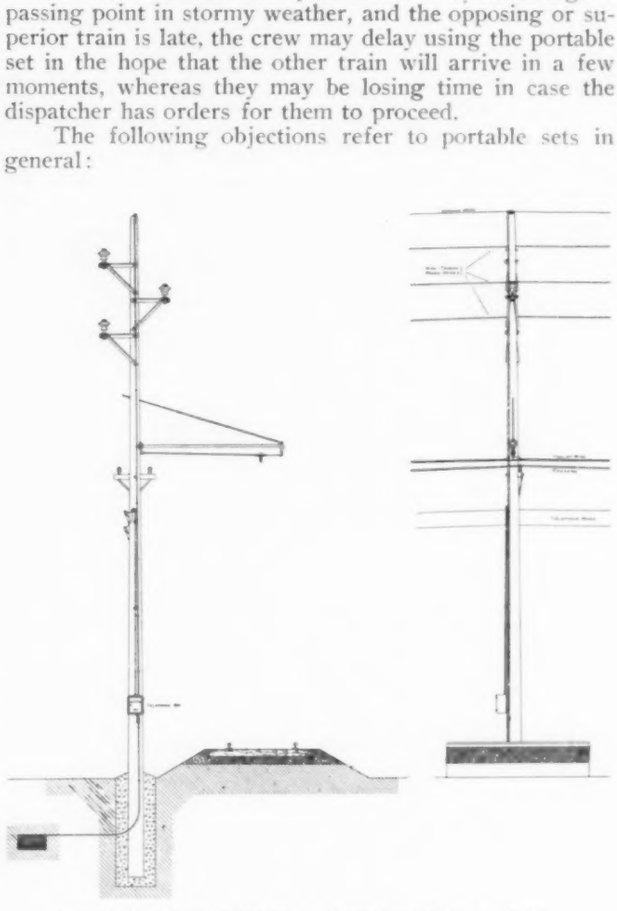


Fig. 2. Stationary Telephone in Weatherproof Box on Pole.

5. If a portable set becomes deranged, no communication is possible until another train arrives.
6. In case of a train wreck, the portable set in the motorman's compartment is apt to be damaged at a time when its use is most necessary.

The last objection can be overcome to a degree by very substantial construction of the set (although this increases its weight), and by carrying it in some other

part of the car. The use of a "fishpole" for making connection with the telephone circuit at any point along the road is most valuable in securing prompt relief in case of train accidents. No satisfactory device has appeared for making connections under all conditions with both wires of a metallic circuit by one pole; the use of two poles is now the most convenient plan. The fishpole method of connection is very satisfactory when used in the daylight by an employee who can distinguish with certainty between the telephone circuit, the feeders and the high-tension wires, which are frequently on the same poles. At night, however, there is great danger in case the telephone circuit is within a few feet of the feeders or the high-tension wires, and connection should not be attempted unless strong artificial light can be obtained.

The stationary type of set is commonly enclosed in a weatherproof iron case and locked. Such sets are often installed on a pole as shown in Fig. 2, but there are still the objections cited above in 2, 3 and 4, which must be overcome. This is done by installing the set in a booth or cabin, which serves to give the telephone set additional protection, to insure privacy and to protect the crew; order blanks may also thus be kept dry and a suitable place provided for filing copies of orders, later to be collected and examined by the superintendent. Fig. 3 shows such a cabin, arranged so that the door may be locked with a switch lock, and equipped with electric lights operated by the trolley current. Stationary sets in frequent daily use are best installed as shown in Fig. 3, but for intermittent and irregular use the expense of

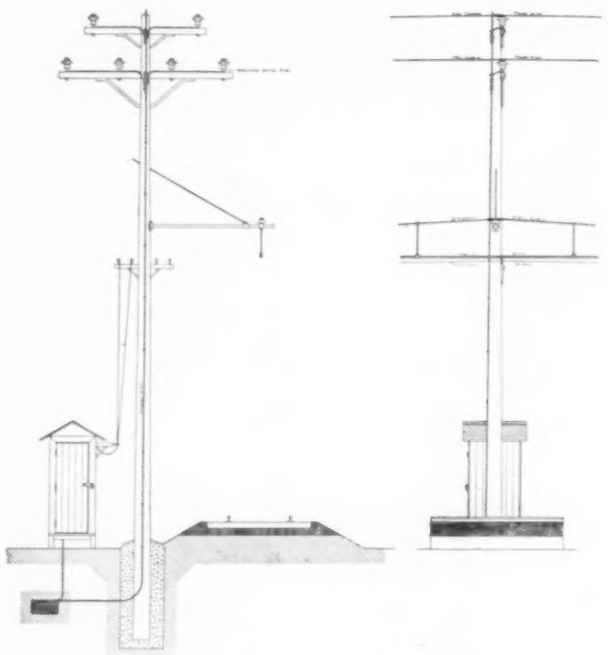


Fig. 3. Installation of Stationary Telephone in Cabin.

a cabin is not always justified, and the set may be installed on the pole, as shown in Fig. 2. One of the great advantages of stationary sets is their availability for use by section foremen, inspectors and linemen.

The most comprehensive telephone service can be obtained by the combined use of stationary and portable types of set; stationary sets installed in cabins should be used at points where the telephone is used daily with considerable frequency; iron box sets installed on the poles may be used at other places, if desired, where less use is made of the telephone. Every train may be equipped with a substantial portable set of very rugged design, carried in the emergency tool box, supplemented with a double fish pole outfit and a reel of flexible conducting cord; jack boxes may be installed along the road as frequently as desired. The portable set, under such circumstances, is intended only for emergency use, and therefore its bulkiness or weight is not especially disadvantageous; moreover, the set is then transported in

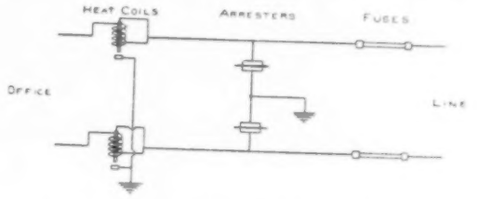


Fig. 4. Protective Device for Telephone Circuits.

a much safer place than the motorman's vestibule, and its readiness in emergencies is much more certain.

PROTECTION OF THE TELEPHONE LINE.

The telephone line itself, while of simple standard construction, is located often within a few feet of the high-tension transmission and always within a few feet of the trolley wire, subject always to the danger of accidental physical contact with the trolley, the feeders or the high tension, caused by the breakage of any one of them, and further subject to inductive interferences, which are extreme on single-phase roads. The telephone line must operate under a group of conditions which are the most difficult encountered anywhere, so far as dangerous exposure and interference are concerned. The matter of protection to the equipment and to persons using it, both from lightning and from foreign currents of potential ranging anywhere between the trolley voltage and the high-tension voltage, requires ample consideration. The protective device which has become standard in telephone work consists essentially of three parts, as shown in Fig. 4. One of these is a circuit-opening device which is commonly a fuse; the second is an arrester or air-gap to ground which is adjusted to break down at approximately a known potential that is regarded as the safe maximum; the third is a heat coil or circuit-grounding device, which operates on currents that are so weak they will not blow a fuse, and are dangerous only when permitted to flow for considerable periods so that they overheat delicate apparatus. In theory, the action of the heat coils is to protect the apparatus against prolonged currents of just sufficient magnitude to overheat its windings, such currents being much below 1 ampere and consequently below the range of fuse protection. The action of the arresters is to break down and provide a shunt circuit to ground for potentials exceeding a predetermined critical value that is regarded as the limit of safety. The fuses serve to open the line after the arresters break down, in case currents of a predetermined and dangerous magnitude flow in from the line to the arresters and thence to ground. Heat coils are not generally regarded as necessary for railway telephone sets; the common protection consists only of arresters and fuses.

The construction of the arrester is generally two carbon blocks separated by a thin sheet of mica having a

small hole so located as to form a gap between the carbon blocks, one of which is connected to line and one to ground; the thickness of the mica regulates the breakdown voltage. Discharges across the gap dislodge particles of carbon, which in time form a partial or a complete short-circuit between the blocks, and it therefore becomes necessary to clean the arrester at periodic intervals, dependent upon the season of the year and the period during which electrical storms occur. A vicious discharge across the gap usually leaves a partial or complete short-circuit behind it. The use of such arresters at isolated points along a telephone line has been found to cause much interruption to service, because of the time consumed in sending repairmen out to clear grounds in them. They further require considerable attention on the door is open, and when the door is closed are wholly disconnected, or only a bell is connected to line; in such cases the protector is usually connected to the telephone set, rather than the line, affording protection while the telephone is in use and disconnecting the arrester from the line at other times. The use of arresters is dependent upon obtaining good earth connections. When the poles are set in earth, a fairly good earth connection may be obtained by wrapping the ground wire about the butt of the pole, before setting a flat copper strip is the superior form of conductor to use, iron being of high apparent resistance and inductance to oscillations of the extremely high frequency which occur with lightning. When poles are set in concrete, the earth connection should be made at some point outside of the concrete.

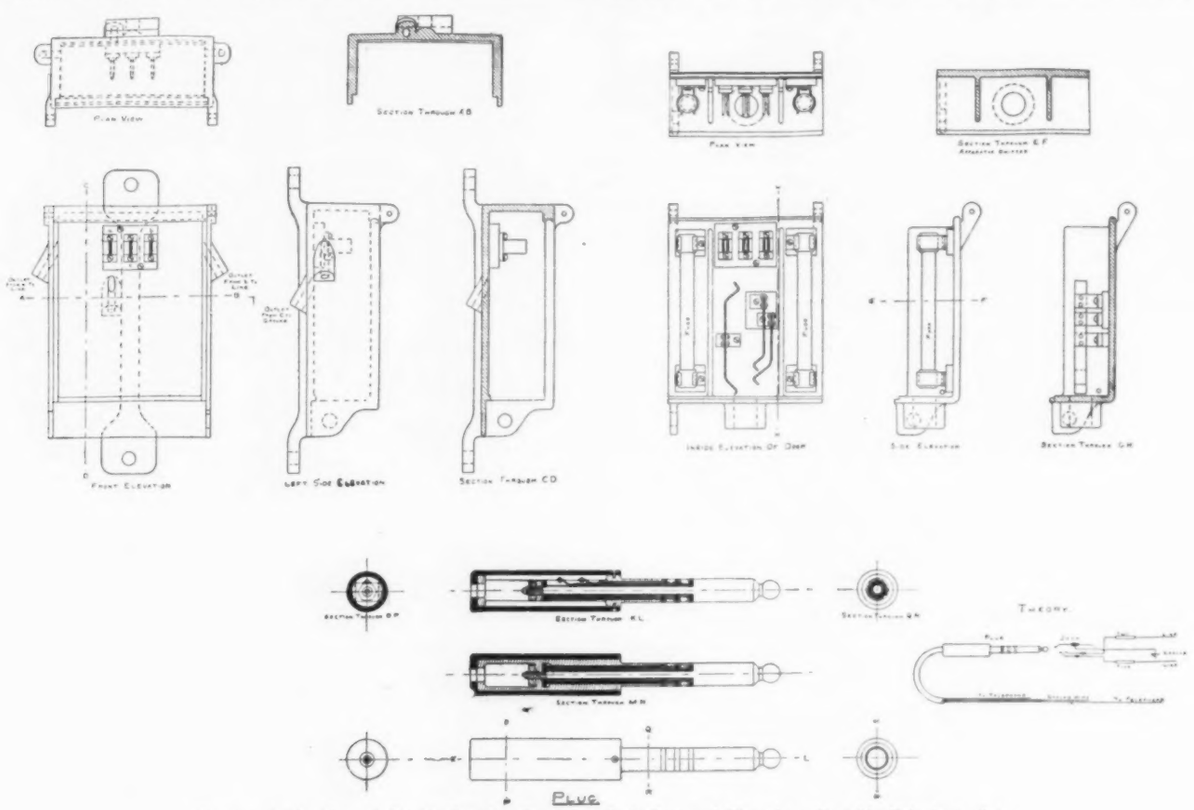


Fig. 5. Application of Circuit Opening Device to Jack Box and Plug for Portable Telephone Sets.

periodic inspections and thus increase the maintenance costs. Metal blocks have beeen tried in place of the carbon and are superior, but no arrester is in general use for telephone protection which is self-restoring and requires no attention. A further difficulty arises from blowing of the fuses as a result of discharges through the arrester to ground, caused by lightning, when the gap is set for only a few hundred volts—300 to 400. Such discharges are transitory and the loss of the fuses is incidental rather than necessary, the result being an interruption to service when next the telephone is needed. If the gap is increased and the size of the fuses also increased until the lightning annoyance is obviated, the amount of protection will have been very much diminished.

GROUNDING TELEPHONE SETS.

Stationary sets of the iron-box type are often constructed so that they are connected to line only when

The resistance of any earth connection can be measured in a simple manner by driving down two temporary grounds, some distance apart, and measuring the three grounds in three pairs; if the measured resistances or impedances of the respective pairs are:

$$Z_1+Z_2=A \quad (1)$$
$$Z_2+Z_3=B \quad (2)$$
$$Z_3+Z_1=C \quad (3)$$

the respective resistances, or impedances if alternating current is used, will be

$$Z_1=\frac{A-B-C}{2} \quad (4)$$
$$Z_2=\frac{A+B-C}{2} \quad (5)$$
$$Z_3=\frac{-A+B+}{2} \quad (6)$$

The metal box or housing of stationary sets and jack boxes should be grounded in order to fully protect employees from accidental shocks, caused by crosses between the telephone lines and the trolley feeders. The type of insulator commonly used upon the telephone line is incapable of withstanding potentials of any considerable magnitude and breaks down at a few thousand volts; owing to its small leakage surface it is not of high insulation resistance in wet weather, and will permit foreign currents of high potential to stray on to the telephone line, as well as allow telephonic currents to leak from wire to wire or from wire to ground. The breakdown of a high-tension insulator, caused in many instances by lightning or by mischievous persons with missiles or firearms, is likely to communicate a dangerous potential to the pole and therefrom to the telephone and signal circuits because of the small insulators used. The fall of potential from a high-tension phase-wire to earth is normally concentrated in the insulator and the potential gradient is very abrupt; when an insulator fails, the fall of potential is concentrated no longer in the insulator, but distributed over the cross-arm and pole, if the same are of wood, and that point of the pole at which the telephone line is supported may be elevated to a very considerable fraction of the full high-tension voltage. Dangerous potentials have been communicated to telephone wires upon the same line of wooden poles with the high-tension, at the time of insulator failures; this potential will be transmitted many miles, perhaps, in each direction from the failure, with great danger to employes who may be using the telephone.

The ideal protection is obtained from metal poles and cross-arms, a special earth connection being em-

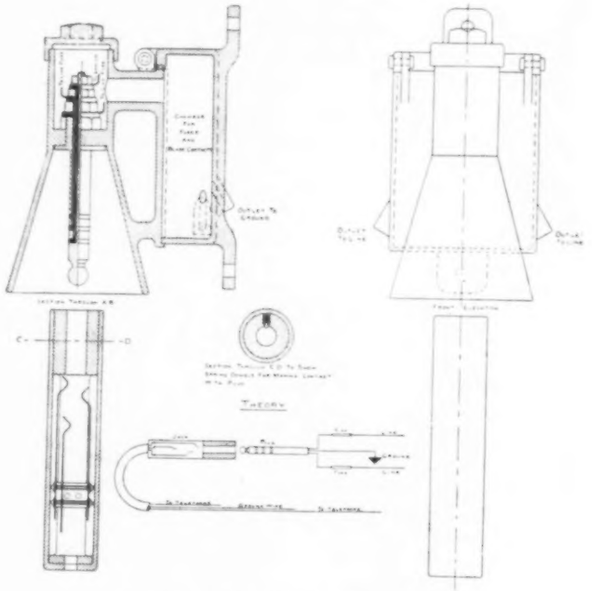


Fig. 6. Plug Box and Jack for Portable Telephones.

ployed to insure always a very low resistance path to earth. High-tension insulator failures could not elevate the pole to a dangerous potential except in the inability of the earth connection to transmit a large volume of current without appreciable potential drop, and this may be avoided by ample surface contact with the earth and high conductivity of the ground lead. In the case of wooden poles, a large degree of protection may be secured by the use of metal cross-arms, grounded as just described. This plan will maintain a zero potential gradient down the pole, in the event of a high-tension insulator failure. When wooden cross-arms are used, protection consists in grounding the metal pins, the ground conductor being carried along the top side of the cross-

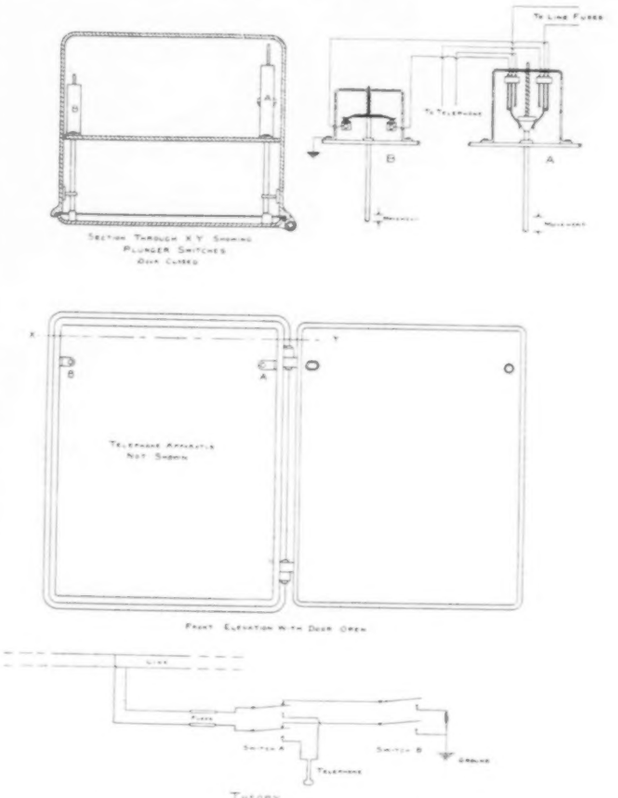


Fig. 7. Application of Protective Device to Stationary Sets.

arm to the pole and thence downward. For full protection against lightning it is good practice to extend the ground lead to the extreme top of the pole, where it may be attached to the ground wire extending along the top of the transmission line, if one exists. One of the advantages of the safeguards last described lies in the protection given to wooden poles and cross-arms from destruction by the arcs which ordinarily accompany failures of high-tension insulators and burn through the cross-arm or pole. Figs. 1 and 2 illustrate this method of protection.

CIRCUIT OPENING PROTECTIVE DEVICE.

A new system of protection is the invention of the writer. When this device is applied to stationary sets or to portable sets with connection boxes, it is impossible to secure connection with the telephone line while it is elevated to a dangerous potential. The system consists of a circuit-opening device located between the line and the telephone or between the line and the connection box and a device for grounding each line-wire in the act of making connection, such grounding being accomplished before connection can be made and removed as the connection is completed. The telephone line is therefore short-circuited and grounded for a brief interval, during which the existence of any dangerous potential will cause

currents to flow through the circuit-opening device and actuate it. This will leave the line open and prevent connection between it and the telephone, although such connection will not be interfered with, in case no dangerous potential is present on the line. Fig. 5 shows this protective system applied to a jack box and plug for use with portable sets. The jack box is designed so that the contact springs and fuses are disconnected from the line upon swinging the front cover outward and upward, and are then in a position for inspection or renewal of the fuses. Connection to line is made automatically upon closing the cover. The elongated plug-tip serves to short-circuit and ground the line-wires, when inserted in the jack. The ground wire is carried through the cord to the portable set so that the latter may be equipped with an arrester if desired, or with a repeating coil whose winding on the line side is grounded at its middle point, or with a bridged impedance grounded at its middle point.

Fig. 6 shows a reversal of the arrangement given in Fig. 5, the plug, instead of the jack, being made stationary in the connection box. The jack springs also are concealed in the hollow handle which forms a terminus for the cord of the portable set and slips over the plug in the connection box. The tip of the plug is grounded and the metal sleeve of the jack is elongated so as to short-circuit the plug rings that are connected to line, and also ground them, for a brief interval while the jack is being pushed into place on the plug. In order to insure good contact between the sleeve and the plug, small radial dowels of metal are let into a longitudinal slot in the sleeve, and by reason of spring pressure they make a rubbing contact with the plug. The fuses are accessible in the same manner as described for the jack box in Fig. 5. Fuses have not heretofore been employed in jack boxes as a means of protection, but the amount of protection which may now be secured by such location of the fuses, in conjunction with the means described for briefly short-circuiting and grounding the line, is believed to warrant their use.

The application of this protective principle to a stationary set is shown in Fig. 7, which illustrates an iron box type of set. Two switches are provided and are actuated by plunger rods, the rods in turn being actuated by inner projections on the door of the box. When the door is closed, switches *A* and *B* are opened; as the door is opened, switch *B* is closed with the first movement of the door and the line wires are thereby short-circuited and grounded. As the door swings open, switch *A* is closed after the door has described a considerable angle, which requires a brief interval of time. During this interval the fuses will open the line in the event that a dangerous potential exists between the wires or between either or both wires and earth. Switch *A*, when it closes, disconnects the short-circuit and the ground and connects the line to the telephone. The telephone set itself may be equipped with an arrester as a protection to the apparatus and the person using it while the telephone is in use; the arrester will be disconnected from the line when the door is closed. Repeating coils or bridge impedances with their middle points grounded also give additional protection. A ground connection from the middle point of the winding of a repeating coil, on the line side, or from a bridged impedance, is not always feasible, owing to excessive noise thereby produced in the telephone receiver, which results from severe inductive interferences. In such cases an arrester with small gaps may be employed. A large degree of protection is secured by the use of a repeating coil, without a ground connection from the center of its line winding; such coils or transformers when used for protective purposes are wound with a one-to-one ratio and are specially insulated to withstand very large potential differences between primary and secondary for short periods. The principal difficulty lies in securing a coil of moderate size which possesses high efficiency, both in talking and in signaling. Talking currents are of variable and ever-changing frequencies, ranging from 100 to 2,000 cycles per second, while the customary signaling or ringing frequency is about 17 cycles. Raising the signaling frequency is one of the means of reducing this difficulty.

The talking or transmission efficiency of any telephone circuit is divisible into two components, the efficiency of the telephone sets and the efficiency of the line circuit connecting them. To obtain satisfactory transmission for a minimum total investment, it is necessary to compare the investment in telephone sets with the investment in the line circuit, and make sure that an increase in efficiency and cost in one cannot be more than offset by a decrease in efficiency and saving in cost in the other. Nowhere is this principle in transmission of more importance, from the cost standpoint, than in the case of long private lines, such as those which form the subject in hand. For the purposes of discussion the following unit costs have been assumed, which are approximate, but in which variations of a few per cent will not offset the conclusions to be drawn.

Cost of stationary iron box telephones	$25.00
Cost of portable telephones	20.00
Cost of connection boxes	2.50
Cost of bare hard-drawn copper wire, per lb	.15
Cost of iron wire, per lb	.035
Cost of stringing copper metallic circuit, pins, insulators, tie-wires, sleeves and labor, per mile	15.00
Cost of stringing iron metallic circuit, same, per mile	13.00

As an illustration, take the case of 50 miles of No. 10 B. & S. gage copper wire, weighing 208 pounds per mile, and costing $77.40 per mile, or a total of $3,870. Assume 10 stationary sets, 10 portable sets and 90 connection boxes at a total cost of $775, which includes an allowance of $1 each or a total of $100 for cost of installation. The total investment is $4,645, of which 83 per cent is for lines and 17 per cent for equipment. The selection of equipment having transmitters of low power and the provisions of insufficient transmitter battery would be of such effect on the transmission efficiency that in the estimate above an additional investment of $5 per telephone set for transmitters of the highest attainable efficiency and batteries of the greatest power permissible without injuring the transmitters by overheating, would permit a reduction in the size of the line-wire. If such reduction amounted only to one gage number, the cost of fifty miles of No. 10 B. & S. gage copper circuit would be $3,240 and the grand total cost of equipment $875, or a total of $4,115, which is a saving of $530.

High efficiency in equipment is much cheaper to secure than high efficiency in the line circuit, and the principle becomes of increasing importance as longer lines are considered. When iron wire is employed the saving is not so great, but in the case cited above a reduction of the wire gage from No. 9 B. W. G. to No. 10 would have resulted in a net saving of $92.50. The highest transmission efficiency for a given investment or the lowest investment for a given total efficiency will be arrived at

by a careful study of all the local conditions in each case and a proper division of investment between equipment and lines.

COST PER MILE OF METALLIC CIRCUIT.

No. 9 B. & S. copper	$77.40
No. 10 B. & S. copper	64.80
No. 11 B. & S. copper	54.60
No. 12 B. & S. copper	46.50
No. 9 B. W. G. iron	34.35
No. 10 B. W. G. iron	30.50
No. 11 B. W. G. iron	27.00
No. 12 B. W. G. iron	24.55

Theoretically, the best division of investment between lines and equipment is secured when an increment of increase in transmission efficiency is obtainable at equal cost, whether in improving the line or the equipment; in practice it works out that the best equipment is none too good.

The choice between portable and stationary sets in any given case, from the standpoint of cost, may be of interest; two typical cases will be considered. Take a road 100 miles in length, with train service each way every other hour; assume that the rolling stock consists of 12 motor cars and 4 locomotives. The cost of 16 portable sets and 100 connection boxes would be $570 plus an allowance of $100 for installation, making a total of $670. The cost of 100 stationary sets, installed, would be $2,600, which gives a large saving in favor of portable sets.

Contrast this with a road 20 miles in length, double track, maximum headway of 5 or 10 minutes and rolling stock of 50 motor cars. The cost of 50 portable sets and 20 connection boxes, installed, would be $1,070, compared with $520 for 20 stationary sets installed. For roads of a type lying between these extremes, the advantages of both types of set are obtainable at a reasonable cost, by locating stationary sets at the points of frequent use and equipping trains with portable sets for emergency use, in connection with jack boxes every few thousand feet. —*Electric Railway Journal.*

Recent Telephone Patents

By David S. Hulfish

It will be the purpose of this department to list all United States patents, as they are issued, which pertain to any branch of the telephone business, giving such data in each case as will enable the reader to judge whether he wishes to see the complete drawings and specifications of the patent. When patents of special interest to TELEPHONE ENGINEER readers are encountered, the descriptive matter herein will be amplified accordingly. A complete copy of drawings, specifications and claims of any patent listed will be furnished from this office upon receipt of ten cents.

902,624. Combination Drop and Jack, with novel means for mounting the drop armature detachably. Burton W. Sweet, Cleveland, Ohio, assignor to Century Telephone Company, Buffalo, N. Y.

902,641. Telephone Substation wall set of compact design, of the pressed metal type. Jules A. Birsfield, Chicago, Ill., assignor to Alfred Stromberg, of same place.

902,642. Transmitter Hinge on the ball and socket principle, bearings being provided to limit the motion to vertical movement only. Jules A. Birsfield, Chicago, Ill., assignor to Alfred Stromberg, of same place.

902,715. Telephone System. A two-way common battery multiple circuit. The line relay is a permanent current path for the line. Elmer R. Corwin, Chicago, Ill., assignor to Monarch Telephone Manufacturing Company, of same place.

902,773. Magnet for Telegraphones. Harve R. Stuart, Wheeling, W. Va.

902,896. Antiseptic Mouthpiece Attachment. John W. McBrine, Medford, Mass.

902,930. Telephone System having interconnections of relays to lines and relays to lamps whereby the number of line relays may be reduced theoretically. Harry G. Webster, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place.

903,197. Transmitter. William Kaisling, Chicago, Ill., assignor to Milo G. Kellogg, of same place.

903,547. Telephone System having an electromagnetic mechanism for controlling the supervisory lamp of a two-wire cord pair. W. W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place.

903,561. Party Line Attachment; a step-by-step auxiliary device to be added at a substation, making the line lockout and selective signal. Joseph A. Geller and Stephen H. Geller, Chicago, Ill.

903,733. Telephone Bracket of the lazy-tongs type; it is provided with a pedal connection for operating it. Benjamin M. Lampert, Cedar Bluffs, Neb. (See cut.)

908,813. Thermal Protector and connections of such detail that all talking contacts in the talking circuit of the heat coil are soldered contacts. Frank B. Cook, Chicago, Ill.

903,811. Repeater for Speech Currents. The details of the veritable resistance are novel, the resistance being controlled by a receiving electromagnet. Jens H. Christensen, Sovejen, Sollerod, Denmark.

903,733.

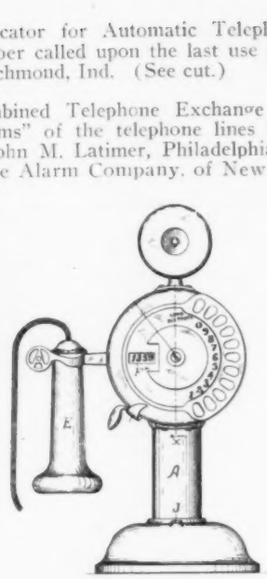
903,812. Central Office Line Protector having novel arrangement of springs and contact parts. F. B. Cook, Chicago, Ill.

Reissue 12,878. Metallic Support for Pole Cross Arms. Edward C. Short, St. Paul, Minn., assignor to Steel Gain Manufacturing Company, Chicago, Ill.

904,105. Switchboard System for common battery multiple, having novel features. Dudley B. Wick, Jr., Cleveland, Ohio, assignor to North Electric Company, of same place.

903,898. Indicator for Automatic Telephone Calling Dial, showing the number called upon the last use of the dial. Richard Sedgwick, Richmond, Ind. (See cut.)

904,441. Combined Telephone Exchange and Alarm System, the "phantoms" of the telephone lines being used in the alarm system. John M. Latimer, Philadelphia, Pa., assignor to Consolidated Fire Alarm Company, of New York, N. Y.



903,898.

904,550. Combined Automatic Fire-alarm, Burglar-alarm and Telephone System. G. F. Milliken, Boston, and F. W. Cole, Newton, Mass., assignors to Gamewell Fire-Alarm Telegraph Company, New York, N. Y.

904,583. Telephone System, covering a specific arrangement of supervisory relays. Harry G. Webster, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place.

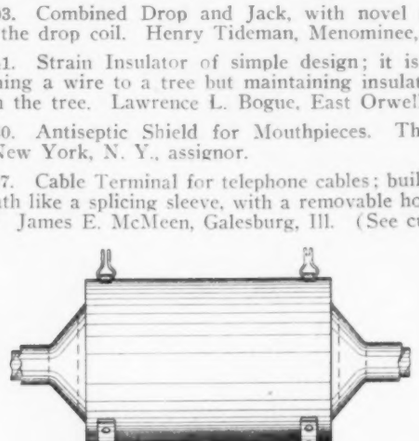
904,850. Telephone, common battery, with polarized line relay. Francis W. Dunbar, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place.

904,903. Combined Drop and Jack, with novel means for replacing the drop coil. Henry Tideman, Menominee, Mich.

905,141. Strain Insulator of simple design; it is shown in use attaching a wire to a tree but maintaining insulation of the wire from the tree. Lawrence L. Bogue, East Orwell, Ohio.

905,330. Antiseptic Shield for Mouthpieces. Thurston M. LaJord, New York, N. Y., assignor.

905,347. Cable Terminal for telephone cables; built upon the cable sheath like a splicing sleeve, with a removable housing protecting it. James E. McMeen, Galesburg, Ill. (See cut.)



905,347.

905,414. Metallic Insulator Pin. Charles G. Ette, St. Louis, Mo., assignor to Ette Investment Company, of same place.

905,503. Inclosed Fuse. Frank B. Cook, Chicago, Ill.

905,619. Combined Drop and Jack. Ernest E. Yaxley, Chicago, Ill., assignor to Monarch Telephone Manufacturing Company, of same place.

905,773. Grounding Clamp for electric wires, of simple strap design. William H. Vibber, New London, Conn., assignor of one-half to Gillette-Vibber Company, of same place.

905,781. Telephone Receiver of novel design. Nathaniel Baldwin, Heber, Utah. (See cut.)

905,854. Testing System for Toll Lines. W. W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, of same place.

905,873. Metallic Cable Hanger. Clement G. Harrington, Maplewood Mo.

905,907. Transmitter Bracket of sheet metal construction. Ernest S. McLarn, New York, N. Y., assignor to Western Electric Company, Chicago, Ill.

905,952. Dry Cell using an expanded metal electrode. Joseph T. Szek, London, England.

906,003. Metallic Insulator Pin. Charles G. Ette, St. Louis, Mo., assignor to Ette Investment Company, of same place.

906,100. Indicator. This is a departure from the usual type of line signaling calling devices; a rotary indicator indicates by its position the number of the calling line, and the operator then picks it up with her answering plug. Edward J. Burke, New York, N. Y.

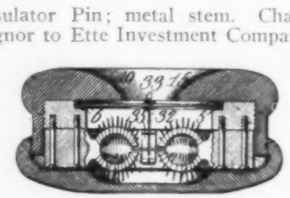
906,448. Spring Clip Wire Terminal for gripping binding posts, etc. Bernard Morgan, Newport, R. I.

906,513. Telephone System, for two-wire multiple. W. W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill.

906,602. Private Branch Exchange Telephone System for common battery working. Frank Arens, Cincinnati, Ohio.

906,615. Heat Coil Repair Device, including a source of current and circuits for heating the coil to restore it to its condition for further service. This is in connection with his patent 903,813 for "contactless" thermal protector. Frank B. Cook, Chicago, Ill.

906,787. Insulator Pin; metal stem. Charles G. Ette, St. Louis, Mo., assignor to Ette Investment Company, of same place.



905,781.

906,874. Telephone Holder. A standard is attached to the top of the desk, and a self-balancing arm supports the desk stand or telephone. Louis S. Hallowell, New York, N. Y., assignor to Fox-Borden Manufacturing Company, of same place.

907,062. Combined Drop and Jack. A novelty is seen in the withdrawal of the drop spool from the front of the device. Tidolf Lidberg, Chicago, Ill., assignor to Swedish-American Telephone Company, of same place.

The Keystone Company's Report

The Keystone Telephone Company has just laid another double armored, 200-conductor, submarine cable across the Delaware river. It is 3,000 feet long and weighs 55,000 pounds, all in one piece; it consumed just twelve minutes to lay the cable from the time the boat started on the Philadelphia side until it reached the Jersey shore. This makes the fourth cable owned by the Keystone interests to be laid across the Delaware river. The new cable was necessary to take care of the increase in business between Pennsylvania and New Jersey points.

The company shows a substantial increase in its monthly net earnings over the corresponding month of the previous year, and notwithstanding the financial depression, the earnings available for interest charges for the first six months of the fiscal year will be over $20,000 in excess of the earnings for the same period last year.

The officials of the company report that they expect to have through direct trunk lines between Philadelphia and Pittsburgh during the year 1909. There is a connection between these points at present, but there are not circuits enough to make the service commercial. This new line will be of great benefit to both Pittsburgh and Philadelphia companies.

Who's Who in the Telephone Game

SAMUEL GROENENDYKE McMEEN got his start when he was only about so old, or at least he got the idea for a start, from a politician of the old-fashioned, come-on type who was pulling the tail feathers out of the great American eagle in an old-fashioned grove in old-fashioned Indiana, where ideas didn't blossom so rapidly as they do now. The particular spell-binder who made the first appreciable dent in Samuel G.'s sense of logic weighed about three hundred pounds avoirdupois and he had a voice to match. He measured up to his physique in everything except in gray matter. We said he was an old-time campaigner.

Samuel Groenendyke was having a Saturday afternoon's vacation. He sat on the very first row of improvised seats which were 2x12 planks laid upon logs for support. It was in the early fall, when shoes and stocking were still considered cumbersome, needless things among the youth of the land. Sam wore glasses even then, and his face was tanned and freckled, his legs were bare and brown. He was bent forward with his arms akimbo and his chin in his palms; his face upturned to the speaker. His feet were tucked under the plank. He heard the great noise on the platform without heeding the flags and the bunting, and after the first pitcher of water disappeared he concluded thus:

WHEREAS, I am small in stature and uncomely, and

WHEREAS, The speaker is all that I am not; therefore be it

Resolved, That it takes brains instead of beef to make a man.

That was a brief, sensible analysis for a mere youth, but it immediately became the essential part of the creed that has made Sam McMeen great. He went right to work on the hypothesis that what he lacked in "beef" he would make up in brain. He never had his fingers crossed and he never spared the midnight oil. He kept at it incessantly, relentlessly, and he's at it yet. By beginning early he had distinct advantage, because it was his ambition to get on and get up. By getting up he got on. Very simple mathematical problem that doesn't require a slide rule to aid in solving.

Among the things that "Mac" acquired along about the same time was geniality. As a youngster he could lay no great claim to good looks, but he could be genial. Mere case of substitution. And he was as genial every morning as a spring morning is on the best of spring mornings. With the geniality goes the palaver and the handshake. "Mac" didn't overlook any bets. He used to talk to the horses and cattle and shake hands with the pump when there wasn't anything else available. Everything was grist for his mill—eternally at it—fighting the specter of beef, which he lacked, for the brain which he didn't lack.

As a Youngster, He Could Lay No Great Claim to Good Looks, But He Could Be Genial.

So we have in Samuel Groenendyke McMeen today, stripped of every other material thing, a big active brain, a happy smile, a beaming eye—still with the glasses—a warm, clinging handclasp and a tendency always to get along. He took all the public schools of Indiana had to offer and then waded through Purdue. He is never so content, away from his family, as he is with George Ade and John T. McCutcheon; but that's another story. Quitting Purdue University, he found service with the Central Union Telephone Company, which operated then in Ohio, Indiana, Illinois and Iowa. During the round of years he had something to do with all the mechanical capacities, including exchange management, and in 1893 he was appointed assistant engineer. In 1896 he was made chief engineer and continued in that position till 1902. In other words, from shinning up poles to the "big smoke" of the works. It took him nearly twenty years, but he cashed in on the early formula.

It's easier to let go than it is to take hold of the bigger things of life, so the step from chief engineer of the Central Union to engineer in charge of telephone central office equipment with the Western Electric Company was easy. With the manufacturing arm of the Bell the telephone engineer has to do with the engineering of all exchange apparatus for use in America and abroad.

It was in April, 1904, when all these ties were severed and McMeen embarked in business on his own account. There were telephone engineers then, but abundance of optimism for the telephone of the future had its allurements for him, and the business was undertaken. A partnership was formed with Kempster B. Miller, and the firm McMeen & Miller continues in business to this time, serving its clients along the several lines contemplated in its establishment.

Some of the principal works with which the firm has been and now is connected are these:

A complete investigation of the fire alarm telegraph system of New York city, this work having been done in 1905 for the New York Board of Fire Underwriters.

As a result of the foregoing investigations, engagement by the city of New York to prepare preliminary plans and specifications for the establishment of a com-

plete and thoroughly new system in the borough of Manhattan.

Telephone exchange systems in a number of cities have been designed by the firm, and it has had active charge of construction in some of them. The largest present work of that kind is in San Francisco, where it is engaged in the design and construction of a complete plant involving four immediate central offices in San Francisco and a number more in other cities about San Francisco bay, all of which towns and cities together comprise the real city of San Francisco. This work is under McMeen's personal charge, and his temporary residence is in that city.

The firm also is engaged in the engineering of a plant for the Houston Home Telephone Company, of Houston, Texas. It has done much work in planning long-distance systems, some of them covering very large and important territories.

McMeen has been for twelve years a member of the American Institute of Electrical Engineers, and was an associate member for a short time prior to that. He is a member of the Western Society of Engineers and of the Chicago Engineers' Club. He has a son 19 years old who is now with the Western Electric Company of San Francisco, and a daughter of 17 summers.

So you will please note that some of these diversions require the consequential essence of brain rather than essence of beef. McMeen has had much to confirm the wisdom of his early fixed purpose. But look at him; he's getting fat, too!

Of Interest to the Trade

Chicago's Electrical Show for 1909

Preparations for the electrical show to be held in the Chicago Coliseum January 16 to 30 are practically completed. The special decorations for the show will involve an outlay of about $25,000, despite the fact that the decorative scheme employed last year was outlined as a permanent feature.

Assistant Manager John J. Schayer, who has had charge of this year's show owing to the illness of Homer E. Niesz, feels particularly gratified with the results to date. The sale of space has been large, and among the exhibitors are: Crane Company, Commonwealth Edison Company, Wagner Electric Company, Federal Electric Company, Cutler-Hammer Company, Pyro One-Light Sign Company, Shelton Electric Company, Lindstrom, Smith & Company, Western Insulation Company, National Battery Company, Perfection Vacuum Cleaning Company, Chicago Fuse Wire & Manufacturing Company, Electric Appliance Company, The Excello Arc Lamp Company, Kellogg Switchboard & Supply Company, The Stoltz Electrophone Company, Stromberg-Carlson Telephone Manufacturing Company, Mathias Klein & Sons, Manhattan Electrical Supply Company, Ft. Wayne Electric Works, Electrical World, Benjamin Electric Company, Electrical Record, Central Electric Company, International Correspondence Schools, McRoy Clay Works, Chicago Pneumatic Tool Company, Robbins & Myers, Appleton Electric Company, United Pump & Power Company, Commercial Appliance Company, Electric City Publishing Company, Taussig & Babcock, Westinghouse Electric & Manufacturing Company, Autolectric Sign Company, General Electric Company, American Steel & Wire Company, National Acme Manufacturing Company, Hall Automatic Clock Company, Swedish-American Telephone Company, Swedish Electric Vibrator Company, Popular Electricity Publishing Company, Peerless Light Company, Palm Engineering Company, Pacific Electric Heating Company, Duntley Manufacturing Company, National Automatic Advertising Company, Jewell Electric Instrument Company, Roth Brothers Company, Crescent Company, H. W. Johns-Manville Company, Red Cross Antiseptic Company, Northern Electrical Manufacturing Company, A. W. Kratz, Illinois Electric Renovator Sales Company, Hurley Machine Company, Murphy Electricity Rectifier Company, National Electric Lamp Association, Electrocraft Publishing Company, Electrical Testing Laboratories, American Electric Fuse Company, The Caloric Company, The Allis-Chalmers Company, North Shore Electric Company, Simplex Company, Cyclone Storage Battery Company, Electric Storage Battery Company, F. B. Badt & Company, Chicago Telephone Company, Mechanical Appliance Company, Western Electric Company, The Connersville Blower Company, Electric Cleaner Company, Pelouze Electric Heater Company, C. S. Neville & Company, Mears Ear Phone Company and National Carbon Company.

The New San Francisco Plant

The vast work involved in the planning and engineering of the San Francisco Home Telephone Company's new system of 65,000 automatic telephones is drawing to a close. In March the actual work of installation will begin. Already 15,000 telephones and other appliances, including switchboards, representing an investment of $1,000,000, are on the way to San Francisco from Chicago. Fifty thousand automatic telephones will be shipped later, after the first shipment has been installed.

For the first time the plans of the Home Telephone Company as to long-distance lines are announced. It is stated that the Pacific States Telephone & Telegraph Company's long-distance lines will be paralleled from Los Angeles to San Francisco and northward to Seattle and Portland. This project has been held in abeyance by the company. The work, which will require an investment of $1,500,000, will be commenced immediately upon completion of the local lines in this city.

The Home Telephone Company will be ready to compete with the Pacific States company by the middle of the year.

Joseph Harris, president of the Automatic Electric Company, Chicago, will remain in San Francisco for several months and direct the work of installation.

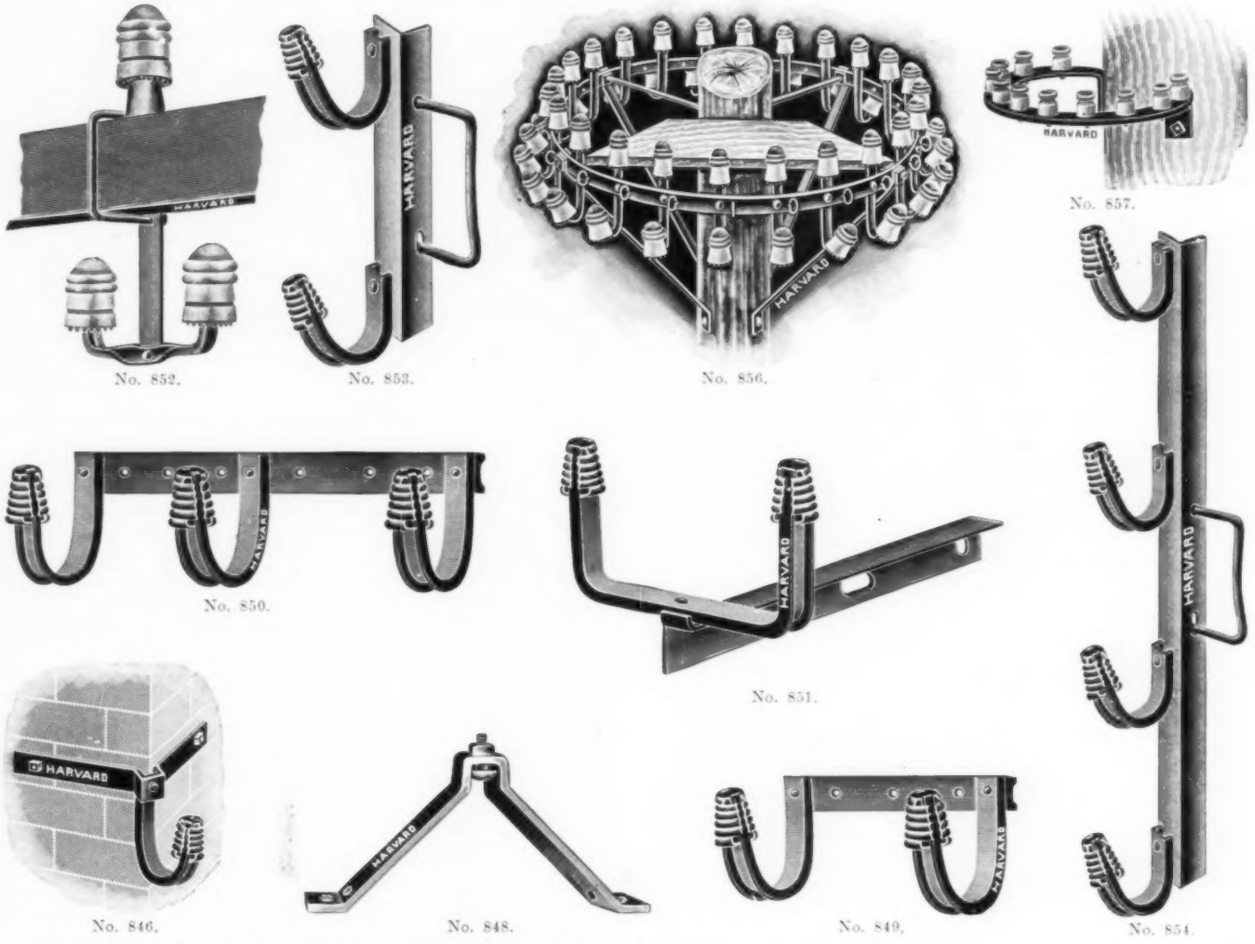
Harvard Electric Company's New Products

Telephone engineers realize that the use of wood for house drops is doubtful economy. Wood soon rots; wood brackets split while being attached to houses; they frequently come with imperfect or split threads; they swell in wet weather, loosening the holding spikes, and the contraction in dry weather leaves them half an inch or more away from their original fastening, while a

storm finishes the pulling off process. The result is a trip of the trouble-man or repair wagon.

Another not infrequent cause of trouble is that wood brackets placed during damp or wet weather are so swelled that they do not accommodate the glass insulator with more than two or three threads, and the drying out or contraction of the wood pin allows the swaying of the lines to pull off the glass, when but a short time suffices to pull off the wood cleats or house wire staples by the weight of the line, plus the swinging glass insulator.

The Harvard Electric Company is making possible the cutting down of this expense for repairs by the excellent line of steel brackets, house fixtures, etc., which are illustrated here. Its brackets, made of channel steel equipped with patented stamped steel spring cushion threads (which cannot break insulators), are hot galvanized in so thorough a manner that they resist weather ravages a great deal longer than the ordinary construction material. In buying steel material, one buys for wear and lasting qualities. Realizing this, the company has insisted on a galvanizing process which is of the highest class, resulting in a thicker coating. It is a well known fact that the usual specifications for galvanizing are based on a coating for iron wire—a small, easily galvanized, smooth surface; the same process would naturally be insufficient for larger, rougher articles. This is why the company is paying for a special process of galvanizing that will produce the longevity, etc., that galvanizing was devised to procure. The house brackets are all made under the rigid inspection of A. L. Haase, who has been identified with the bracket industry for ten years.



No. 852. No. 853. No. 856. No. 857.

No. 850. No. 851.

No. 846. No. 848. No. 849. No. 854.

Products of the Harvard Electric Company, showing No. 846, Two Point Corner Iron; No. 848, Bracket Foot and Corner Iron; No. 849, Two Point Electric Light Bracket, Horizontal; No. 850, Three Point Electric Light Bracket, Horizontal; No. 851, Two Point Break Arm; No. 852, Underhang Bracket; No. 853, Two Point Transposition Bracket; No. 854, Four Point Transposition Bracket; No. 856, 48 Pair Circle Pole Top and Seat; No. 857, Knob Rack.

The uses of house drops or service brackets are familiar to all. Underhang brackets are designed to increase the facilities of cross arms on a full route until it is economical to erect extra arms, at which time the bracket can be taken down and used elsewhere. They bolt around the arm and need no extra tools for attachment beyond the ordinary lineman's pliers. Terminal brackets are designed to bolt through the cross arm on a terminal pole. This method puts the strain on the arm exactly opposite the through bolt holding the arm to the pole and does away with the twisted arm which has been first to go down in a sleet storm.

Another interesting new product of this company is a copper sleeve, of which a cross section is shown here. The Harvard sleeve has a beveled edge which creeps around the inside of the barrel when the sleeve is twisted, so that it wraps tightly and lies snugly around a wire.

The company's new type No. 6 switch box is also shown. Its salient features are: Its ready adaptability to all conditions and the ease with which it can be changed into a gang box by the use of a spacer without entirely removing the screws. The ears are turnable in the same manner, and contractors will appreciate the fact that there is no chance to lose screws and no time lost trying to find screw threads.

Interesting literature can be obtained by writing to the Harvard Electric Company, 58 W. Van Buren street, Chicago, Ill., or 136 E. Liberty street, New York, N. Y.

Memorial Tablet to Ampere

A tablet to the memory of Andre-Marie Ampere, the famous French physicist, was unveiled December 3 at Ampere, New Jersey. The tablet is the gift of Dr. S. S. Wheeler and is located in the beautiful new station of the Delaware & Lackawanna railroad. M. Jules Jusserand, the French ambassador, was received at the factory of

The Ampere Memorial Tablet.

the Crocker-Wheeler Company, nearby, at 3 o'clock on the afternoon set for the ceremony. A procession was formed with an escort of uniformed guards recruited from the company's force. With the ambassador were Mayor Cardwell, of East Orange; President Campbell, of the Newark Board of Trade; representatives of the four national engineering societies; R. W. Pope, secretary of the American Institute of Electrical Engineers; T. Commerford Martin, past president of the institute and New York Electrical Society; Professors Crocker, Sever, Pupin and Arendt, of Columbia University; Professor Parmly, of the College of the City of New York; Peter Cooper Hewitt and Thomas Ewing. Dr. Wheeler was accompanied by Gano S. Dunn, vice-president of the Crocker-Wheeler Company, and Rodman Gilder.

A platform in the station, under the tablet, was draped with American and French flags, as was the station itself. The spectators, among whom were many ladies, filled the room to its capacity, and the whole city of Ampere was in festive array in honor of the occasion.

Dr. Wheeler's address was very interesting, reviewing the career and achievements of Ampere and dwelling particularly on the adoption of his name for the standard unit of electric current. He then invited M. Jusserand to unveil the tablet and the beautiful bronze plate was revealed.

The ambassador, in his address, eloquently expressed his pleasure as a citizen of Lyons, France, in finding this beautiful American city bearing the name of his distinguished fellow townsman. He extolled the energy and public spirit of Dr. Wheeler in the presentation of the tablet, and remarked felicitously that many streets and squares in France are named for distinguished Americans. Hearty applause was accorded his address.

The tablet was officially received by Vice-President Caldwell of the Delaware & Lackawanna railroad, who thanked Dr. Wheeler for his generosity and congratulated him upon the enterprise which built up the city of Ampere. A cordial message of appreciation from Governor Fort to Dr. Wheeler was read, the governor being unable to attend in person. A luncheon served in the executive offices of the Crocker-Wheeler Company followed the exercises.

Trade Notes

The exhibit of the Automatic Electric Company at the recent independent convention contained some very interesting features. The new attachable keyboard, by means of which common battery manual telephones may be transformed into full automatic instruments; and the semi-automatic district station system, intended to benefit those companies which desire to change gradually from manual to automatic, are among the latest developments of the company.

The Commercial Appliance Company, Chicago, announces that its principal exhibit at the coming electrical show will be the "Germless" glass transmitter mouthpiece, which can be readily cleaned and kept free of disease germs. The company will also exhibit the Equipoise telephone arm, a convenient adjustable bracket for the support of a telephone desk set.

The bulletin issued for convention distribution by the Swedish-American Telephone Company, Chicago, is a very business-like little booklet. Not content with cataloging the varied products of the telephone company, advertisements are carried of nine other concerns whose lines of effort, being parallel, can never meet. One hesitates to suggest that they improve the booklet, for Swedish-American talk alone is always interesting; but they certainly do not detract from its appearance, and suggest a happy economy.

John G. Roberts, formerly head of the patent department of the Western Electric Company, has opened offices at 1451 Monadnock building, Chicago, and will undertake general employment as a consulting electrical engineer and expert in patent causes. It is his intention to specialize to a considerable extent in the telephone field.

In the Field

PERSONAL NOTES.

E. H. Moulton, president of the Tri-State Telephone & Telegraph Company, Minneapolis, Minn., was chosen president of the International Independent Telephone Association at the recent twelfth annual convention of that body at Chicago. He succeeds A. C. Lindemuth in that capacity.

The association is to be congratulated upon its selection of a leader. Mr. Moulton is a practical business man; and while he has all the enthusiasm of the independent spirit, he is shrewd enough to foresee whatever difficulties may arise before him, and to prepare for them. He was one of those who went before the Chicago council committee and told that body of the attempts of independent companies to get into Chicago. He has offered to connect his line with the Illinois Tunnel Company's system; but he has little hope, until conditions change, of seeing either his company, or any other independent company, in Chicago.

For forty years he has been in the banking business, part of the time in London and Frankfort. As a student of all kinds of investments, he gives it as his opinion that there are no securities equal, for safety and profit combined, to those issued for gas, electric light, and telephone. He is an able advocate of telephone competition.

Victor Stevens, former president of the Dubuque (Iowa) Telephone Company, has been chosen president of the Dubuque and Plattsville Interurban Railway.

L. D. Brainard, Oneonta, N. Y., has been appointed manager of the Home Telephone Company, of Dunkirk, N. Y.

J. C. Gibson has been appointed manager of the Toledo, Ohio, exchange of the Central Union Telephone Company.

Silas Linville, Hooker, Okla., has been appointed manager of the Tyrone Telephone Company, of Tyrone, Okla.

Wesley Priser has assumed the management of the Dunlaps Mutual Telephone Company at Dunlaps, Ind.

W. D. Clark, Hillsdale, Mich., has been appointed manager for the Michigan State Telephone Company in Saginaw.

C. T. Peters, Stonington, Ill., has been appointed manager of the Windsor Telephone Company, of Windsor, Ill.

H. J. Haley, Paris, Ky., has been appointed manager of the Carlisle Home Telephone Company, of Carlisle, Ky.

F. D. Clark, Harrisburg, Pa., has been appointed manager of the Chambersburg exchange of the Bell Telephone Company of Pennsylvania.

J. W. Cherry, Toledo, Ohio, has been appointed manager of the Urbana Telephone Company, of Urbana, Ohio.

F. J. Bickner, Minneapolis, has been appointed manager of the Northwestern Telephone Exchange Company's exchange at New Ulm, Minn.

William McGovern has been appointed chief engineer of the Wisconsin Telephone Company at Milwaukee, Wis.

Sumner Lloyd, Fayetteville, Tenn., has been made manager of the Cumberland Telephone and Telegraph Company, at Winchester, Tenn.

C. F. Lambert, formerly manager of the Nebraska Telephone Company at Nebraska City, Neb., has been made manager of the company's exchange at Hastings.

Caspar Olstad has been made manager of the Northwestern Telephone Exchange Company at Eveleth, Minn.

Howard H. Herr, who has for six years been manager of the Ottumwa Telephone and Electric Company, of Ottumwa, has retired.

Charles M. Fosdick, assistant traffic engineer of the Central Union Telephone Company, Indianapolis, Ind., died recently at Fitchburg, Mass.

NEW TELEPHONE COMPANIES.

LOXLEY, ALA.—A telephone company has been organized in Baldwin county with $2,500 capital stock. J. C. Stapleton, of Belforest, is president, and Arthur Cheney, of Loxley, is secretary.

RASPBERRY, ARK.—The Raspberry Telephone Company has organized with John W. Hensley, president; John Willis, secretary, and Bart Rudden, treasurer. The company will build a line from Raspberry to Solo.

BROOMFIELD, ARK.—A new rural telephone company has been formed here. William Dollar will be president, and James Turner, secretary and treasurer. The construction of the plant will commence at once.

TURLOCK, CAL.—The Turlock Home Telephone and Telegraph Company has been organized to operate the local telephone exchange. The officers are: President, John L. Randolph; vice-president, J. C. Williams; secretary, A. J. Eddy; treasurer, T. H. Adams; manager, W. T. Thornburg.

DOVER, DEL.—The Eastern States Telephone and Telegraph Company has been incorporated with a capital of $500,000. The incorporators are Richard J. Morgan and Robert Voss Marye of New York, N. Y., and William S. James of Brooklyn, N. Y.

HAHIRA, GA.—The Hahira Telephone Company has been organized with L. M. Stanfill, president, and R. Y. Scruggs, secretary.

REUBENS, IDAHO.—The Reubens Rural Telephone Company of Reubens, Nez Perce county, has been incorporated with a capital stock of $2,000. The incorporators are: James Bonnallie, A. T. Paige, C. Chambers.

RUPERT, IDAHO.—The Settlers' Mutual Telephone Company has been incorporated with a capital stock of $48,000. The incorporators are: L. R. Adams, Roy W. Adams and Charles C. Nelson.

MCLEANSBORO, ILL.—The McLeansboro Telephone Company has been incorporated with a capital stock of $2,500 by M. M. Stephensen, J. R. Cross and others.

ELNORA, IND.—The Elnora Co-operative Telephone Company has been incorporated with a capital stock of $2,200, and will establish an exchange and telephone lines in Elnora and operate toll lines connecting other towns in Daviess, Knox and Greene counties. Thomas M. Sears, J. E. Pershing, Harry Hitchcock, J. W. Pruitt are directors.

LADORA, IOWA.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000. The officers are W. L. Morse, president; Fred Geuhorn, vice-president; M. W. Kelting, secretary; H. C. Gates, treasurer. Directors, E. H. Matteson, J. W. Bean and George W. Rumple.

PARK, KAN.—The Park Telephone Company has been incorporated with a capital stock of $10,000.

LEONARDVILLE, KAN.—The Riley County Telephone Company of this place has been incorporated with a capital stock of $10,000.

SCIENCE HILL, KY.—The Science Hill Telephone and Exchange Company has been incorporated with a capital stock of $800. The incorporators are William Lowery, T. W. Denney, A. Y. Hays and others.

BURR OAK, MICH.—The Burr Oak Mutual Telephone Company has been organized with $10,000 capital, and will have connection with the Bronson exchange of the Bronson Mutual Telephone Company.

PLEASANTON, MICH.—The Southeast Pleasanton Telephone Company has been organized with the following officers: President, James M. Allen; vice-president and secretary, Jones Babcock; treasurer, O. Kirstead.

ST. CLAIR, MICH.—The Lindsey Road Telephone Company has been organized. The officers are: President, Julius Beyer; vice-president, Otto Bandlow; secretary, Albert Beyer; treasurer, August Guildenstein.

ADAIR, MICH.—The Casco Roadway Telephone Company has been organized. The officers are: President, Louis Maedel; vice-president, William Eschenberg; secretary, Henry Lutes; treasurer, Joseph Cobbledick; trustee, George Seifert.

SAGINAW, MICH.—The Valley Home Telephone Company, a corporation which is to take over practically all the Independent telephone interests in northeastern Michigan, including the exchanges at Saginaw, Bay City and Flint, has been organized. The authorized capital of the new company is $2,500,000. The board of directors is as follows: Fred T. Woodwarth, E. F. Carrington, George E. Wedthoff and L. W. Kessler, all of Bay City; John L. Jackson, John F. Brand, C. O. Trask and John J. Speed, Saginaw; R. B. McPherson, Howell; James B. Gibbs, Ithaca, and Charles W. Liken, Sebawaing. The following officers have been elected: President, E. D. Carrington, Bay City; vice-president, John L. Jackson, Saginaw; secretary, C. O. Trask, Saginaw; treasurer, J. F. Bond, Saginaw.

MINNEOTA, MINN.—A new company has been formed to build a rural telephone line from this place to Nordland. C. K. Melby will be president, and L. S. Teigland, secretary.

STILLWATER, MINN.—Farmers of Stillwater Junction have organized a new telephone company. The following officers have been elected: Edmund Wolff, president; R. O. Ulrick, secretary-treasurer; H. Fenner, A. Robert and Frank Schwartz, directors.

CENTERVILLE, MO.—The Centerville Telephone Company has been organized with the following officers: President, Glen D. Mains; secretary-treasurer, Frederick Dunlap. Directors: J. L. Williams, Halbert Myers, Joseph Cockley, William Woods, Frederick Dunlap and Glen Mains. The company is building a line from Newville to Centerville.

JEFFERSON CITY, MO.—The Farmers' Union Telephone Company of Neosho has been incorporated with a capital stock of $1,750. The incorporators are A. L. McConnell, J. B. Graves, George Hoover, William T. Matthews and others.

ADVANCE, MO.—The Advance Telephone Company has been organized here. The officers are: President, J. H. Schonhoff; secretary-auditor, W. E. Finney. The company has taken over the property of the Puxico Central Telephone Company. The capital stock of the company is $12,000.

HELENA, MONT.—Articles of incorporation have been filed by the Marysville Rural Telephone Company.

MILES CITY, MONT.—The Montana, Wyoming & Southern Railway Company, recently incorporated with a capital stock of $5,000,000, is authorized to engage in the telephone and telegraph business.

CULBERTSON, MONT.—The Dakota Western Telephone Company has been incorporated by H. C. McCartney and others. The capital stock is $200,000.

BARTLEY, NEB.—The Bartley Mutual Telephone Company has been incorporated with capital stock of $12,000 by Edward Sughrause, D. L. Wolf and others.

COTTONWOOD GROVE, NEB.—The Cottonwood Grove Mutual Telephone Company, of Dawson county, has been organized with a capital stock of $700. The incorporators are John Henry, J. H. Hover, and others.

LINCOLN, NEB.—The Spring Branch Telephone Company, with a capital stock of $5,000, has filed articles of incorporation with the secretary of state. W. S. Roberts is president and the headquarters will be at Disney, in Holt county.

BUFFALO, N. Y.—The American Telephone Company has been incorporated with a capital of $300,000. The directors are Herman R. Pease, Luther Hatch, John J. Tisdale, Barnet W. Harris, Reginald F. Penton, John G. Herb, Oliver O. Butcher, all of Buffalo.

EAST BERNE, N. Y.—The Berne Home Telephone Company has been incorporated with a capital stock of $10,000. The directors of the company are Henry Bins, Luther D. Hungerford, Nathaniel D. Gallup, Winnefred S. Dyer, of East Berne; George Palamatier, of Thompson's Lake, and Wallace E. Dietz and Watson T. Chesbro, of Berne.

HILLSDALE, N. Y.—The Hillsdale Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are Frank R. Gilbert, Edward T. Logan, and Jacob Pfeiffer, all of Hillsdale.

PHELPS, N. Y.—The Phelps Home Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are C. M. Clark and H. F. Flint, Clifton Springs, and W. A. Hawe, Phelps.

CARTHAGE, N. C.—The Co-operative Telephone Company has been granted a charter. The capital stock is $25,000. J. F. Cole, G. McLeod and C. F. Leavitt are the incorporators.

BELFIELD, N. D.—R. C. Davis, O. F. Olson, Edward O'Connor, and others, are the incorporators of the Belfield and Northwestern Telephone Company. The capital stock is $5,000.

LEIPSIC, OHIO.—The Leipsic Mutual Telephone Company, of Leipsic, has been incorporated by George Gores, W. W. Dibble, A. J. Hoffan and others.

HOOKER, OKLA.—The Farmers' Telephone Company has been organized with a capital stock of $2,000. The officers are W. M. Atkins, president; William Dixon, vice-president, and Robert Harville, treasurer.

CARNEGIE, OKLA.—An Independent telephone company, known as the Carnegie Telephone Exchange, has been incorporated with a capital stock

of $10,000. The directors are G. O. Hall, W. P. Pevy, and Mrs. May Hall, all of Carnegie.

PENDLETON, ORE.—The Interstate Telephone Company has been incorporated with a capital stock of $50,000. The incorporators are M. H. Kirkham, M. J. Ready and T. E. McGinitie.

BIG SPRING, PA.—The Big Spring Telephone Company has been organized with the following officers: President, O. C. Tritt; vice-president, Edward Dunlap; secretary-treasurer, O. J. Myers. Directors: A. S. Montgomery, Charles Brandt, Robert Koons, A. G. Myers, A. J. Myers, C. C. Myers, Isaac Vanasdale and G. A. Rea.

CHAMBERSBURG, PA.—The Falling Spring Telephone Company has been organized and will operate a line between Stoufferstown and the head of the Falling Spring. The officers are: President, David Metz; vice-president, John S. Wiles; secretary, Jacob S. Stoner.

LEWISTOWN, PA.—The Lewistown Rural Telephone Company has been incorporated with a capital stock of $5,000.

IPSWICH, S. D.—The Union Township Telephone Company has been incorporated with a capital of $10,000. The incorporators are S. W. Mount, E. L. Bucklen, John Sloan, H. Strouble, George Fritz, all of Union township, Edmunds county.

SOUTH SHORE, S. D.—The Antelope Valley Telephone Company has been incorporated by William Boier, F. A. Zirble and J. J. Fry.

GLEASON, TENN.—The Gleason Rural Telephone Company, Weakley county, has been incorporated with a capital stock of $1,000. The incorporators are J. E. Goldsby, A. W. Brawner, L. W. Carter, W. H. Williams, J. B. Gatewood, Will Morn and G. Courtwright.

TYRONE, TEXAS.—The Farmers' Telephone Company has been organized with a capital stock of $2,000. The officers are W. M. Atkins, president; William Dixon, vice-president; Robert Harville, treasurer.

NEW KENT, VA.—The New Kent Telephone and Telegraph Company has been incorporated with $5,000 capital stock. The officers are C. L. Harrison, president; R. E. Richardson, vice-president, both of Talleysville, Va.; T. N. Harris, secretary-treasurer, New Kent.

SEATTLE, WASH.—The Skamania Co-operative Telephone Association of Stevenson has been incorporated with a capital stock of $10,000. The incorporators are A. Fleischauer, P. C. S. Wills and R. C. Sly.

WILSON CREEK, WASH.—A new telephone line from Wilson Creek to Stratford, by way of Wilbur flats, is being projected. Thomas Pearce, of Stratford, is president.

NORTH YAKIMA, WASH.—The Lower Naches Telephone Company has been incorporated. The capital stock is $3,500 and the incorporators are John Dobie, W. T. White, A. H. Blair, Lawrence Jacobson and C. W. McCormick.

UNIONTOWN, WASH.—The Uniontown Telephone Company has been incorporated by Lambert Taufen, W. W. Miller and George A. Drissel. The capital stock is $5,000.

ARBORVALE, W. VA.—The Arborvale Mutual Telephone Company has been incorporated. The capital stock is $2,000 and the incorporators are S. B. Hammond, of Arborvale, and E. A. Hudson, F. H. Warwick, L. H. Moomaw, J. H. Judson and John R. Hevener, of Green Bank.

WHEELING, W. VA.—The Paradise and Raymond City Telephone Company, Putnam county, has been incorporated. The capital stock is $20,000.

BARTON, WIS.—The Barton Rural Telephone Company has been incorporated with a capital stock of $300. The incorporators are Henry Albright, Frank Mueller and William Lexenberger.

CAMBRIDGE, WIS.—The Farmers' Equity Telephone Company has been incorporated with a capital stock of $4,000. The incorporators are J. C. Hanson, John Christianson and James E. Hill.

FOND DU LAC, WIS.—The Eldorado and Friendship Telephone Company has been organized to establish telephone service in the places named. The capital stock of the new company is placed at $5,000, and the incorporators are James Reilly, W. H. Keys, L. G. Barnes, William C. Ray and W. P. Reilly.

LEBANON, WIS.—The Lebanon Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Henry C. Uttich, August H. Maas and August C. Neitzel.

BARTON, WIS.—The Barton Rural Telephone Company has been incorporated with a capital stock of $4,000. The incorporators are H. L. Brown, G. E. Dickinson, F. G. Henske, E. H. Sherwin and F. R. Schwandt.

HARTFORD, WIS.—The Hartford Rural Telephone Company has been organized with a capitalization of $1,500. The officers are: President, E. M. Anderson; vice-president, Daniel Schultz; secretary, A. W. Brown; treasurer, Michael Reik.

GALLINGERTOWN, ONT., CAN.—The Stormont Telephone Company has been organized with the following officers: President, Dr. E. Brown, Aultsville; vice-president, W. A. Edwards, Gallingertown; secretary-treasurer, W. H. Alexander, Pleasant Valley; directors, O. M. Rombough, Pleasant Valley; William Scott, Pleasant Valley.

DUBLIN, ONT., CAN.—The McKillop, Logan and Hibbert Telephone Company has been incorporated here with a capital stock of $15,000. The provisional directors are A. V. H. Mitchell, Dublin, Ont.; W. W. Sadler and J. Norris, Hibbert township.

FRANCHISES ASKED AND GRANTED.

CRIPPLE CREEK, COLO.—E. S. Sterett of Henry, Ill., has asked for a franchise to establish a new telephone system here.

MOUNDS, ILL.—The Home Telephone Company of Cairo has been granted a 20 year franchise here.

GALVESTON, ILL.—The Kokomo Telephone Company has asked for a franchise here.

EVANSVILLE, IND.—The American Telephone and Telegraph Company asked for a franchise to string wires here.

HICKMAN, KY.—The Hickman Independent Home Telephone Company has been granted a 20 year franchise here.

MT. STERLING, KY.—The Old Kentucky Telephone Company has obtained a 20 year franchise here.

SWANVILLE, MINN.—The Elmdale Rural Telephone Company has been granted a franchise here.

COLUMBIA, MO.—J. W. Grain and others have asked for a franchise here.

ALBANY, MO.—J. H. Jones, J. B. Grace and others have secured a franchise here.

LEXINGTON, MO.—The Kansas City Long Distance Telephone Company has asked a franchise for long distance lines in Lexington.

RICH HILL, MO.—D. B. Hickey has asked for a franchise here.

SPRING BLUFF, MO.—P. E. Gerber has been granted a franchise from this town to Leslie.

UNION, MO.—F. W. Merk has obtained a franchise in the western part of Franklin county.

JAMESTOWN, N. D.—Lewis C. Lane has been granted a franchise here.

FREDORIA, OHIO.—The Berringer Telephone Company has been granted a franchise here.

ADA, OKLA.—The Farmers' Independent Telephone Company has obtained a franchise for 25 years here.

HURON, S. D.—F. H. Kent, C. F. Koepp, C. E. Bryant and others have petitioned for a franchise here.

GOLDENDALE, WASH.—The Union Telephone & Telegraph Company has been granted a franchise here.

HALIFAX, N. S., CAN.—The Wentworth Home Telephone Company has been granted a franchise here.

FINANCIAL ITEMS.

TROWBRIDGE, ILL.—The Trowbridge Mutual Telephone Company has increased its capital stock from $1,500 to $3,000.

BOSTON, MASS.—The American Telephone & Telegraph Company has increased its capital stock from $250,000,000 to $300,000,000.

LANSING, MICH.—The Grand Ledge Telephone Company has increased its capital stock from $25,000 to $50,000.

CHILLICOTHE, MO.—The People's Telephone Company contemplates an increase of capital stock and a bond issue.

MIDDLETOWN, N. Y.—The Orange County Telephone Company has increased its capital stock from $10,000 to $50,000.

CINCINNATI, OHIO.—The Cincinnati and Suburban Bell Telephone Company will increase its capital stock from $5,808,050 to $6,374,050.

BRISTOL, WIS.—The Bristol Telephone Company has increased its capital stock from $3,000 to $8,000.

CUMBERLAND, WIS.—The McKinley Telephone Company has increased its capital stock from $1,500 to $3,000.

NORTHFIELD, WIS.—The Northfield Farmers' Telephone Company has increased its capital stock from $7,000 to $14,000.

RUSSELL, MAN., CAN.—The Russell Telephone Company has increased its capital stock from $5,000 to $25,000.

MISCELLANEOUS NEWS.

SCOTT, ALA.—Lee Dobbins, of this place, is interested in the extension of telephone service in this county.

FORT SCOTT, ARK.—The Independent Telephone Lines Association will build a line to Little Rock.

HUNTSVILLE, ALA.—The Southern Bell Telephone and Telegraph Company has begun numerous extensions throughout Madison county.

SAN FRANCISCO, CAL.—The Home Telephone Company is planning to install an exchange at San Dimas.

COLONA, CAL.—A. W. Morris, John McKay and others are interested in purchasing a telephone line here.

VIDALIA, GA.—The Vidalia Telephone Company is planning a line to Cedar Crossing.

LEWISTON, IDAHO.—The Interstate Telephone Company is about to build an exchange building.

BLOOMINGTON, ILL.—The McLean County Telephone Company will rebuild its toll lines.

HOFFMAN, ILL.—The Sigel Mutual Telephone Company has purchased

LITTLE ROCK, ARK.—The Southwestern Telephone and Telegraph Company announces an active campaign of long-distance extensions in this vicinity.
the Hoffman Telephone Company.

HARMON, ILL.—The Green River Telephone Company will construct a line to Amboy.

WARSAW, IND.—The Commercial Telephone Company will build a new line to the east.

STRUBLE, IOWA.—The Plymouth Telephone Company intends to install a new switchboard.

CEDAR RAPIDS, IOWA.—The Cedar Rapids & Marion Telephone Company is contemplating the erection of a two-story building.

MT. VERNON, IOWA.—A. Bunham has sold the Oxford Junction telephone system to Otto Wettstein, Jr., of La Porte City, Iowa, and F. H. Shimanek, of Oxford Junction.

OAKLAND, CAL.—The Pacific States Telephone and Telegraph Company will expend over $100,000 in overhead and underground construction.

BREAUX BRIDGE, LA.—Dr. A. J. Dauterive and Collins Conrad have bought the interest of J. R. Donohoe in the Breaux Bridge-St. Martin Telephone Company.

SIOUX CITY, IOWA.—The Sioux City Automatic Telephone Company will make many improvements at an early day.

DENVER, COLO.—The Colorado Telephone Company will spend about $800,000 in extensions and improvements, including underground.

KINGSLEY, IOWA.—The Kingsley Telephone Company will install a new switchboard.

WAUKON, IOWA.—The Standard Telephone Company will make many improvements in its plant.

AUGUSTA, GA.—The Southern Bell Telephone and Telegraph Company suffered a fire loss of $8,000 here recently.

LIBERAL, KAN.—The Liberal Mutual Telephone Company is building a new office in this place.

LYONS, KAN.—The Lyons Telephone Company will extend its cable line east.

COOLIDGE, KAN.—The Holly Telephone Company is planning to make many improvements to its system here.

PEORIA, ILL.—The Central Union Telephone Company will expend $15,000 in fitting up its Bluff exchange.

NICKERSON, KAN.—The Nickerson Telephone Company will erect an office building here soon.

WICHITA, KAN.—The Independent Telephone Company will make many improvements and build a new line.

AMES, IOWA.—The Iowa Telephone Company will install a new telephone system here.

LEXINGTON, KY.—The Fayette Home Telephone Company will install a new switchboard.

SERGENT, KY.—The Letcher County Home Telephone Company will install a spstem at Wright.

CRISFIELD, MD.—The Islands Telephone Company will build a cable line here.

NEW ORLEANS, LA.—The Cumberland Telephone and Telegraph Company will install a new exchange in Carrollton.

WYANDOTTE, MICH.—The Interstate Telephone Company will install an exchange here.